ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

APRIL 1961

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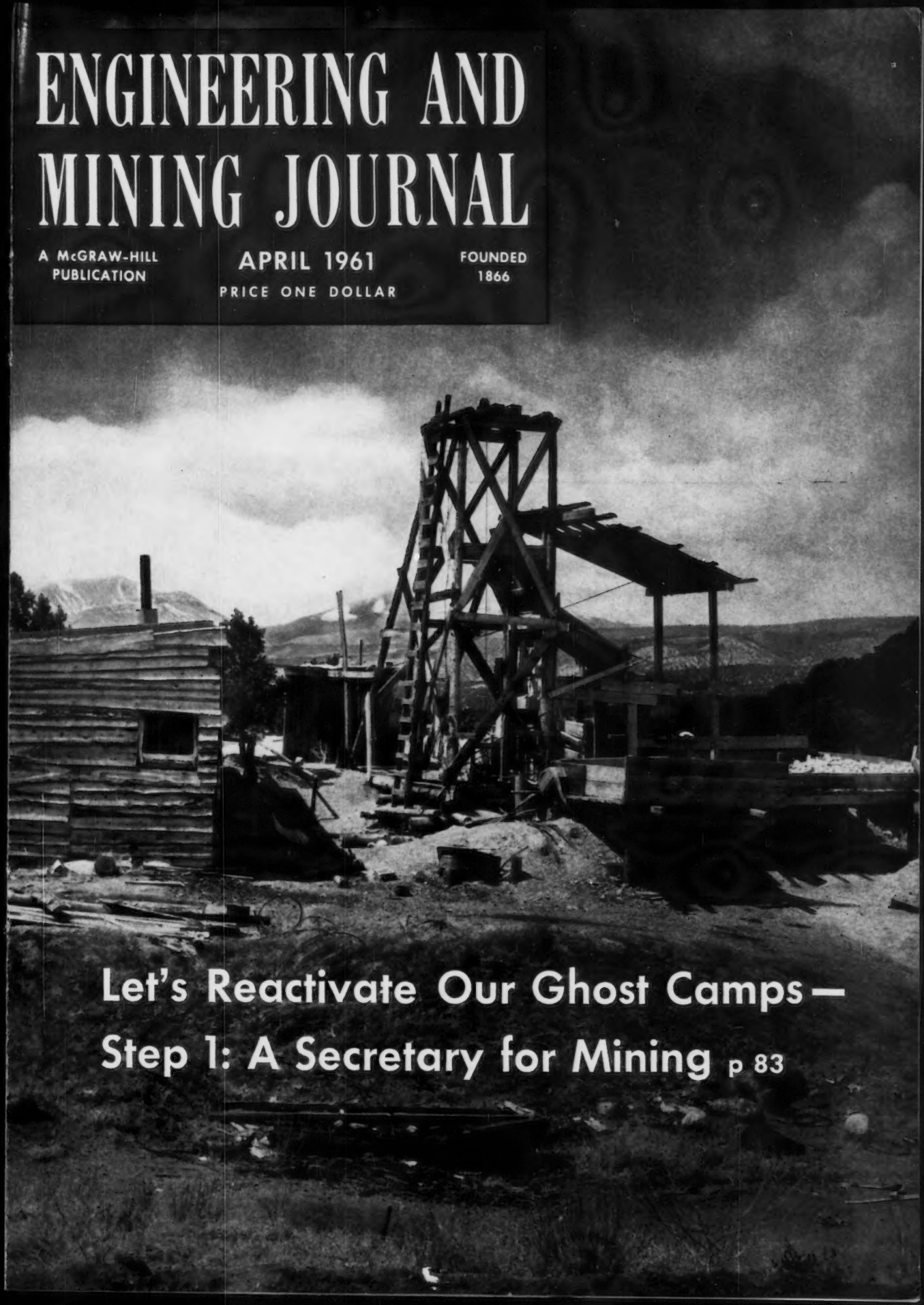
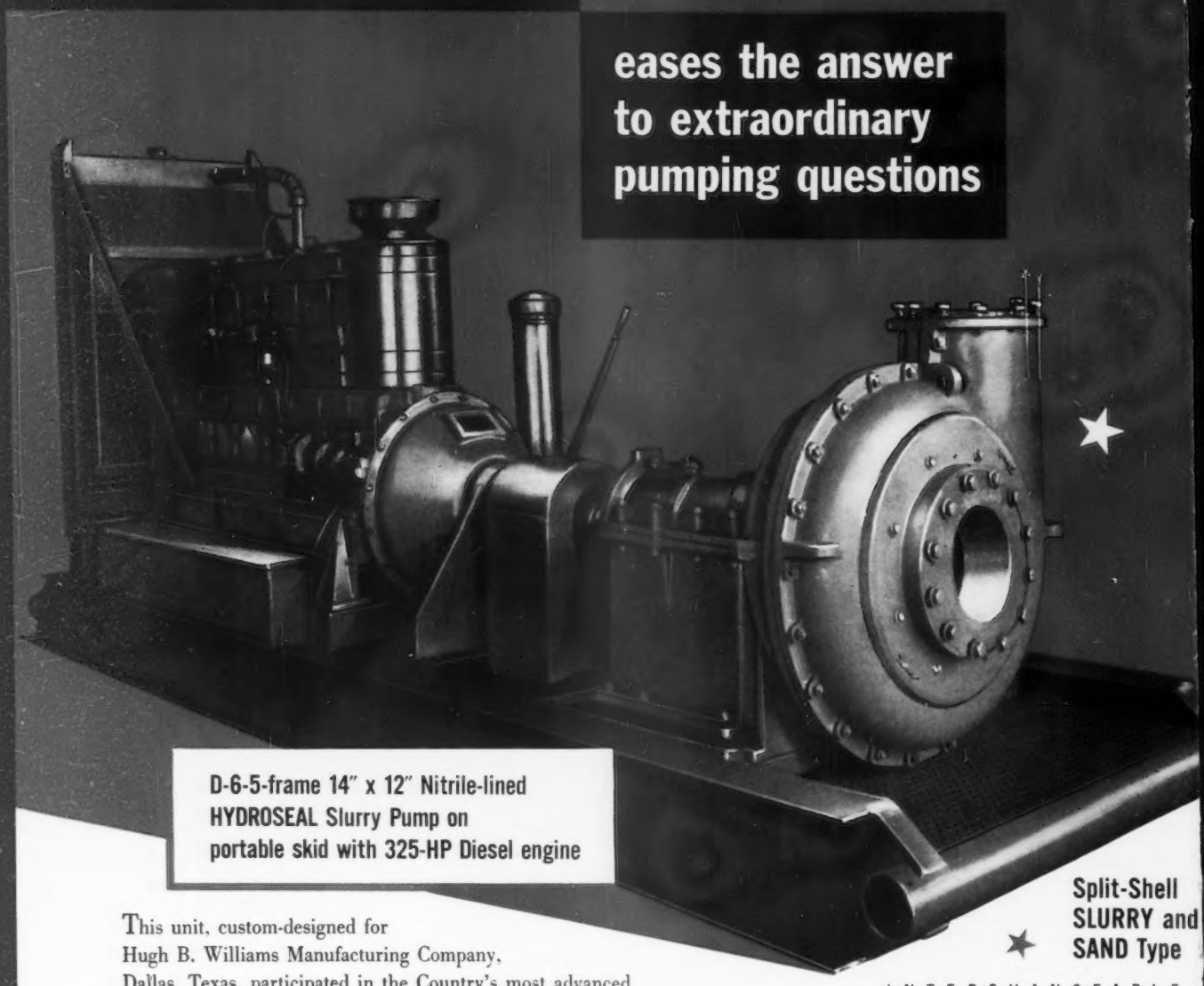


Let's Reactivate Our Ghost Camps— Step 1: A Secretary for Mining p 83

Versatility

eases the answer to extraordinary pumping questions



D-6-5-frame 14" x 12" Nitrile-lined HYDROSEAL Slurry Pump on portable skid with 325-HP Diesel engine

This unit, custom-designed for Hugh B. Williams Manufacturing Company, Dallas, Texas, participated in the Country's most advanced "big-hole" rotary-drilling achievement—90 inches in diameter by 710 feet deep—near Grants, New Mexico. To serve as a mine escapeway and as a ventilation shaft, the hole was drilled through solid rock for Kermac Nuclear Fuels Corporation by Kerr-McGee Oil Industries, Inc., Oklahoma City. Feeding from a prepared pit, this Hydroseal pumped mud to the drill up to 8,000 GPM.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—P.O. Box 635, Paoli, Pa.
Representatives throughout the World

★ **Split-Shell SLURRY and SAND Type**

INTERCHANGEABLE

HYDROSEAL
operates with sealing liquid

CENTRISEAL
delivers the pulp undiluted

A-S-H engineering and the flexibility of the A-S-H line of pumps can help you solve your toughest pumping problem. Write us today.

HYDROSEAL *and CENTRISEAL*

SAND, SLURRY & DREDGE PUMPS

MAXIMIX RUBBER PROTECTED

"WE NEED ROCK AND LOTS OF IT—THAT'S WHY WE USE

Magnetorque-equipped P&H shovels"

... Sam Braen, Inc., Wyckoff, N.J., largest producer of highway and paving materials in Northeast U.S.A.

Sam Braen, President, reports—"*Our 2½ and 3½-yard P&H shovels are real 'rock movers.' Magnetorque swings are faster and smoother than anything I've ever seen in the industry. Our schedule requires rock and lots of it—that's why we use our P&H shovels for this operation.*"

2 P&H Shovels keep production in high gear. Oscar Dufour, Quarry Superintendent, uses his P&H rigs to handle all rock excavation for the stone quarry operation. These P&H rigs maintain a 20-second work cycle. Magnetorque Drive—a P&H electro-magnetic system to control swings — makes the cycles faster and smoother, permits more accurate loading of trucks. His operators can work all day without tiring, so he gets more yardage.

P&H rigs give more efficient, trouble-free operation. Art Whitesell, operator of the 3½-yard P&H, has this to say—"It has plenty of power for rock work . . . and compared to friction clutches that heat up and have to be adjusted, Magnetorque remains the same all day, even under heaviest digging. When operating on a slope and swinging up-hill with a load, Magnetorque always swings the machine easily, without over-heating."

Sam Braen's report is typical of users' experience throughout the world with Magnetorque equipped 2½ and 3½-yard P&H excavators.

For the name of the P&H Distributor nearest to you and Case History 131 on this Sam Braen, Inc., job, write to Harnischfeger Corporation, Milwaukee 46, Wisconsin.

HARNISCHFEGER
Milwaukee 46, Wisconsin

P&H
POWER CRANES & SHOVELS

P&H LINE: Electric Excavators: 3½ through 10 yards • Diesel Excavators: ½ through 4 yards • Truck Cranes 12½ through 90 tons

Mining Calendar

International Symposium on Agglomeration, Philadelphia, April 12-14 1961

Pacific Northwest Metals and Minerals Conference, local sections, AIME-ASM, April 13-15

Wyoming Mining Association Convention, Rawlins, Wyo., April 21-22 1961

AIME-Southwest Mineral Industry Conference, Stardust Hotel, Las Vegas, Nev., April 24-25 1961

High Temperature Materials Conference, Cleveland Section, AIME, Hotel Pick-Carter, Cleveland, April 26-27 1961

16th Purdue Industrial Waste Conference, Purdue Memorial Center, Lafayette, Ind., May 2-4

Sixth Annual Uranium Symposium, Grants, N.M., May 12-14 1961

Canadian Nuclear Association meeting and conference, Lord Simcoe Hotel, Toronto, May 16-17

37th annual conference of the Lake Superior Mines Safety Council, Hotel Duluth, Duluth, Minn., May 25-26

Diamond Drilling Symposium, Broken Hill branch, Australasian Institute of Mining and Metallurgy, Broken Hill, N.S.W., Aug. 21-25

11th National Chemical exposition, Chicago Section, American Chemical Society, Chicago, Sept. 5-8

American Mining Congress annual convention, Seattle, Wash., Sept. 11-14

Commemoration of the 50th Anniversary of Froth Flotation in the U.S., sponsored by MBD of SME, Cosmopolitan Hotel, Denver, Sept. 17-20 1961

Northwest Mining Association Convention, Davenport Hotel, Spokane, Wash., Dec. 2-3 1961

Coming Up

Next month—Few innovations in the mining industry have come in for more discussion, opposition and partisan support than the concept of industrial engineering. E&MJ asked Kennecott Copper Corp., one of the leading users of IE, for a statement of results.

The article, with attributable cost savings documented, will appear in May.

In the future—A series of special reports on various vital segments of mining and processing technology.

The reports will be written by experts in their various fields, and will acquaint today's mining man with all that is new, to help get the job done better and at a lower cost.

95th YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

APRIL 1961

A McGRAW-HILL PUBLICATION

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Rubber takes pounding that wears holes in steel

BIG chunks of ore—some weighing up to 2 tons—crash down from that vibrating feeder to a wear pad below. This terrific pounding 8 hours a day, 5 days a week, quickly wore holes in a wear pad of ½" thick steel plate, caused frequent shut-downs for repairs and replacement.

To avoid these costly delays, a B.F.Goodrich distributor suggested a wear pad made of a rubber called Armorite, specially compounded to stand this sort of a beating. This rubber is soft enough to *give* under the pounding it gets, yet so tough that it is even used in some places to carry broken glass.

The Armorite wear pad stood up under the pounding for 14 months —six times longer than the steel plate. And the Armorite wear pad pictured at left, which replaced the first when it finally wore out, is expected to last even longer because of a different method of installation.

B.F.Goodrich Armorite can be used in dozens of ways—as a liner, curtain, throw mat for protection against abrasives. Can be ordered with or without a reinforcing back of fabric, fiber or steel. Your B.F.Goodrich distributor has full information on Armorite. And, as a factory-trained specialist in rubber parts, he can answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-990, Akron 18, Ohio.*

B.F.Goodrich

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Articles in this issue of

ENGINEERING AND MINING JOURNAL

Continued from p 2

84 The Wabush Pilot Plant: Lead-Off to $200-million Development

The Wabush Lake iron-ore deposit in Canada's Labrador trough will have some $200-million poured into its development. An important part of this will be for the concentrating plant. With stakes that high, the Wabush Iron Co. participants wanted to be sure they built the right kind of plant to do the job.

Hence a modern pilot plant was built, to test the milling characteristics of the intermediate-grade ore. With a capacity of 30 ltph, it was big enough so its results could be confidently projected to a full-size plant. Its flowsheet is based on autogenous grinding and spiral concentration; and a magnetic concentration circuit treats the one-fifth of the ore that is magnetite.

Over 40,000 tons of the plant's concentrates were shipped in 1960 for successful tests in steel mills.

92 Thompson Nickel Output Offsets Cuban Losses

International Nickel Co. of Canada's foresight in developing the Thompson project in Manitoba's frontier was fortuitous. The rated annual capacity of 75-million lb of nickel will go far to offset the loss of Cuban nickel to the Free World incurred by confiscation of properties by the Castro government. The property was named after Dr. John F. Thompson, honorary chairman of Inco, who had served the company for 53 years prior to retirement last year.

96 Percussive Drill Cuts Exploration Costs

Because of high cost and poor core recovery from diamond drilling, Pinnacle Exploration Co. tried percussive long-hole drilling for exploration. The result: better samples and greatly reduced cost.

Pinnacle operates the Pitch Mine, a uranium producer in the Marshall Pass District, Colo. Their problem is to locate mineralized sedimentary pendants that project into Precambrian metamorphics. With the present method, all drilling is overhand and cuttings are saved every 4 ft. The holes, which may be drilled up to 200 ft, are then checked with a geiger probe.

98 Air-Powered Device Speeds Dynamite Loading

The pneumatic cartridge loader, a development of the Nitroglycerine Co., Sweden, enables powdermen to load dynamite at about the same speed they can load bulk ammonium nitrate. Besides increasing the loading speed, the loader increases the degree of packing in the hole. For bench blasting in Sweden, a dense bottom-loaded dynamite booster for AN/FO mixtures is sometimes prepared with the loader—a technique designed to increase blasting efficiency. Underground loading and safety considerations are also explained.

100 Case History of Alimak in Tough Ground

At the Steward Mine in Butte, an Alimak Raise Climber was used in driving a 7x7-ft vertical ventilation raise 208 ft in 146 man shifts. Temperature and humidity were high (93° F, relative humidity 90%), retarding over-all performance. Compared to a timbered raise driven at the same time, the Alimak raise cost 33% less and was driven 48% faster. Several modifications to the Alimak Raise Climber are explained.

102 Spencer's Explosion Tests Emphasize Initiation Systems

Spencer Chemical Co., one of the companies now testing explosives under water, has come up with a new evaluation system, one that relates useful energy to cost. A table emphasizes the importance of various initiation systems with regard to the amount of energy released by various explosives and gives the useful explosive energy in ft-tons per dollar.

NEW heavy-duty crawler drill

MOST RUGGED—tons of sound design
MOST POWERFUL—outperforms 5½" drills
MOST VERSATILE—4" to 6½" holes, vertical to horizontal

The new Ingersoll-Rand Crawlmaster is a *multi-purpose machine* that meets every requirement for percussion, rotary or Downhole drilling of 4" to 6½" blast holes in any type of ground. Here are just a few of its outstanding features:

Constant-Pressure, Double-Acting Hydraulic Feed—smooth, infinitely-variable power for drilling pressure or pulling stuck steels. Drill won't jump ahead in pockets or fissures.

Simple Hydraulic Control Of All Tower Positions. Tilting of tower on yoke and raising or lowering of yoke hydraulically powered by separate cylinders. All throttles outfront for easy operation.

Throttle-Controlled Reverse Rotation permits fast uncoupling of steels without having to climb tower to reverse drill.

Ejector-Type Dust Collector has no moving parts to wear out or maintain. A simple air-jet does all the work.

Heavier—Extra weight is reflected in sound design assuring extra stamina for the toughest drilling jobs. Has rugged, tractor-type crawlers with enclosed gear drive.

Four 30" Stroke Hydraulic Leveling Jacks permit accurate tower positioning with maximum stability on rough terrain.

Hoist, Rod-Changer And Hydraulic Wrench greatly simplify addition or removal of steel sections.

Interchangeable drills and rotation units permit one machine to be used for percussion, rotary or Downhole drilling of 4" to 6½" holes, taking power from a 600 or 900 cfm portable compressor. For a new high in drilling speed and economy, ask your I-R engineer for the Drillmaster story. Or send for Bulletin 4211.

Ingersoll-Rand
33A5 ♥ 11 Broadway, New York 4, N.Y.

A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

95 YEARS OF MINING

The following news items are reprinted substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which became *E&MJ*.

CALIFORNIA, JANUARY 1887—Borax was discovered in California in 1856, and since that time but one company has been formed for its production. About two tons of crude crystal are produced daily.

IDAHO, FEBRUARY 1887—A correspondent of the Lake Superior *Miner* writes from Rocky Bar, Idaho, Nov. 26th, as follows: These gold regions are all very dull, not one of them having come up to the representations. Business has fallen off, and the sheriff is the only man that finds employment. The idea of gold and silver mining is always pleasing, and people rush after such a mine with avidity, not stopping to look into the expense, character of veins, or any of the elements of business . . . I have seen trains leave that there was not money enough in the party to pay toll at the ferries.

MONTANA, FEBRUARY 1887—"H.H.S." writes to the Montana *Democrat* from the Hot Springs District, Jan. 7th: I was really astonished during my peregrinations to various parts, when I took into consideration that it was midwinter in these hyperborean regions, to see men in every direction as far as the eye could reach, perforating the surface of terra firma in pursuit of the precious metal . . . From information which I have already received, there will be at least six mines running in the Hot Spring district the ensuing season, and being located within thirty miles of Virginia City they will give a stimulus to business there such as the denizens have not experienced since the palmy days of Alder gulch.

NEVADA, FEBRUARY 1887—The Comstock—The *Enterprise* says: The Yellow Jacket Company have opened a fifth level in their old works, at the depth of 600 feet, where they have a good body of rich ore, which they will proceed to take out when the retimbering of their old shaft is completed.

This month in

ENGINEERING AND MINING JOURNAL

Continued from p4

Behind the By-Lines

One of the nicest things about this job is watching an idea grow from the thought to the outline to the printed page—and it's even more fun to be in on the process.

Take this month.

The chief editor, who combines photography and mountain climbing with some other talents, stumbled on a hanging valley in Colorado a couple of years ago. He found some impressive, and mightily symbolic subjects—photographed them, and filed them.

A few weeks ago, we got chatting about "depressed areas," a phrase that's been popular in the business press. "Wanna see a picture of a depressed area?" says he.

The pictures are on the cover and on p 83, where the editorial discusses "What Killed Ophir," an obviously once-prosperous mining camp, and offers the preliminary step in a program to put the mining industry in the United States back on its feet.

Since then, we've done some digging on our own. The name Ophir first appears in Genesis, in the section that young Francie, in "A Tree Grows in Brooklyn," called "the begats."

But then, in First Kings 9:10 . . . "And they came to Ophir, and fetched from thence gold, four hundred and twenty talents, and brought it to King Solomon." And, the book goes on to say, that was one of the talents that made Solomon so attractive to Sheba. But that's another story.

" . . . And the Navy also brought gold from Ophir, brought in from Ophir great plenty . . . and precious stones." Kings 10:11

Apparently the government took more than a slight interest in the doings at Ophir back in Biblical days, as the government of a more recent time made its move toward the Colorado counterpart (p 83). And, we must assume, the result was eventually the same, for, in Second Kings 22:48—

" . . . And Jehoshaphat made ships of Tarsus to go to Ophir for gold . . . but they went not . . . "

Just one more, and we'll go. From Job 28:16 " . . . For (wisdom) cannot be valued with the gold of Ophir."

There's been a change in the contents of this issue, and we must apologize to you and to Kennecott's Mr. B. Blain Bradford, who has written an excellent summary of the Utah Copper Division's experience with industrial engineering.

Mr. B. has eschewed generalities to quote some dollar savings which KCC attributes to IE, and it's a fine article. You may have noticed that we plugged it last month in our "Coming Up" section, on p 2. Well, sir, it was all set to go when the dedication story of Inco's new Thompson nickel mine in Manitoba came down the pike. There wasn't time to re-make the whole issue, so Mr. Bradford and IE got pulled out to make room for Inco. We can only offer apologies and the consolation that it happens in our news pages every blasted month. Next month, for sure, Mr. B.

While we were doing the above Biblical research, our 11-year-old asked us if we'd heard about the clergyman who greeted his parishioners with, "Read any Good Books lately?"

New M-S-A® Pager gives you the convenience and flexibility of a telephone with the amplification of a loud speaker

Now, with one versatile communications unit, you can page key personnel over a loud speaker or converse semi-privately by phone. A flip of the switch on the new M-S-A Pager lets you do either.

Uses Existing Lines

The new unit is a completely self-contained, transistorized telephone. Individually battery-powered, these units utilize existing phone lines, and can be used in conjunction with most other telephones.

Simultaneous Paging

Ten or more Pagers can be installed on a single line. This makes it quite simple to page key men from a number of points . . . simultaneously. Once the man answers, a flip of the switch converts the Pager into a regular telephone for private or semi-private conversing.

24 Volts for Paging . . . 12 Volts for Talking

Two dry cell batteries provide the power source. And the power is expended only when the unit is in use, thus conserving battery life. Estimated battery life: 2 to 3 months on a 5% duty cycle.

Easy Installation and Maintenance

Weighing about 25 pounds, the M-S-A Pager can be mounted on a timber or a rib. All parts readily accessible with removal of four fastening screws which open the front half of the case. Transistors are vibration-proof . . . no filaments . . . so high efficiency, long life are assured.

For additional information, ask the MSA representative to call. And write us for helpful new product data bulletin.

Mine Safety Appliances Company, Pittsburgh 8, Pa. In Canada: Mine Safety Appliances Co. of Canada, Ltd., 500 MacPherson Avenue, Toronto 4, Ontario.

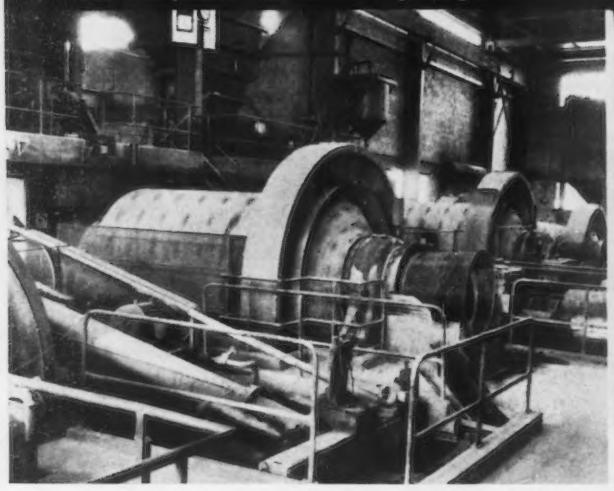
MSA

Another example of

DORR-OLIVER PROJECT

At The New Jersey Zinc Company's

One of three Dorr 8' x 32' Recip-rocating Rake Classifiers at The New Jersey Zinc Company's plant operates in conjunction with rod mills in grinding circuit.



Regrind circuit includes two 12' dia. Dorr Bowl Classifiers (one shown below) for separation of fine sands.

With its world-wide engineering experience in handling virtually all types of solids-liquids unit operations involved in wet chemical, metallurgical and industrial processing, Dorr-Oliver is able to offer a complete project engineering service covering all phases of plant design and construction.

Recognition of the value of this service is offered in the increasing use of Dorr-Oliver project engineering by leading producer companies. One example is The New Jersey Zinc Company's 2500 TPD zinc flotation plant at Friedensville, Pennsylvania in which D-O played a major role in plant component design. In addition to engineering services, Dorr-Oliver also supplied rake classifiers in the grinding circuit, bowl-type classifiers in the regrind circuit, tray thickeners for middlings recovery, thickeners and a disc type vacuum filter in the final recovery circuit.

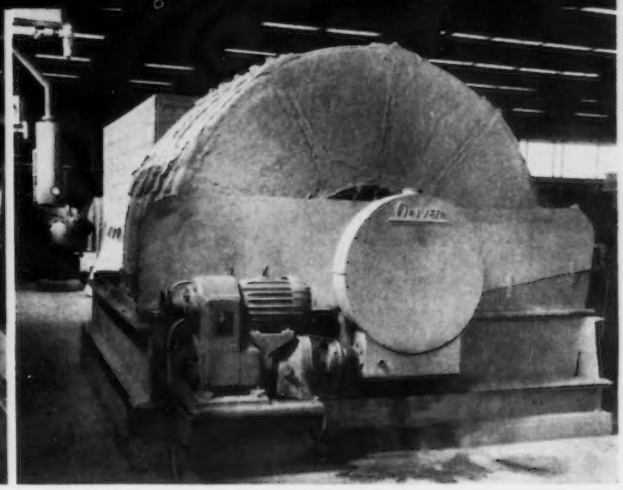
The scope of Dorr-Oliver engineering services is indicated at right. For specific information on how we can help on your particular project, write Dorr-Oliver Incorporated, Stamford, Connecticut.

ENGINEERING

2500 TPD flotation plant

35′ dia. Dorr Thickeners — 2 units installed — handle concentrates in final recovery ciruit.

8′6″ dia. by 7-disc American® filter handles thickener underflow. Cake is conveyed to storage or smelter.



HERE'S WHAT DORR-OLIVER PROJECT ENGINEERING INCLUDES:

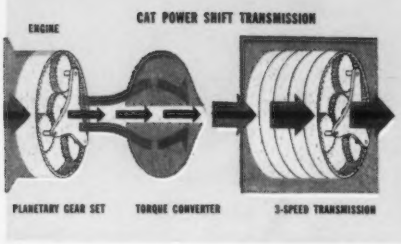
Laboratory Testing
Pilot Plant Demonstration
Flowsheet Preparation and Engineering Studies
Cost Estimates
Plant Design and Specifications
Purchase of Equipment
Erection and Construction
Supervision of Initial Operation
Training of Plant Personnel

Booklet Gives Complete Details and Examples of Installations

A newly published bulletin describes the scope and services offered by Dorr-Oliver Project Engineering, as well as typical plants that have been designed for companies in all parts of the world. Ask for Bulletin No. 8010.

DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT



The exclusive Cat power shift transmission works like this: The engine drives planetary gears in the flywheel, where output torque is divided. Part of it is routed to the transmission through a torque converter (providing anti-stall and load-matching ability). Part goes direct to the three-speed transmission (provides economy and fast response of direct drive). It's one ton of muscle built with the precision of a fine watch.

WITH CAT POWER SHIFT TRANSMISSION IN A D8H, A MAN'S FINGER TIPS CAN CONTROL 30-50% MORE PRODUCTION

Your present equipment may move material at low cost—but here's one reason a D8 Series H Tractor may move it a lot cheaper.

It's the Caterpillar power shift transmission—the only transmission available that combines the advantages of direct drive, torque converter drive and power shifting in a single unit. It greatly increases operator efficiency—offers important new opportunities for broadening your profit margin.

Here's how this big step ahead in transmission design helps your operator get more work from the machine: A single selector lever replaces the familiar master clutch, gear change and forward-reverse levers. Using this single selector lever, the operator can shift on the go in a split-second even under full load. He changes speed or reverses direction with finger-tip ease . . . without clutching . . . without braking . . . without even lifting his arm from the arm rest. And the lever is mounted for left-hand control, leaving the right hand free for maneuvering the tractor or controlling the dozer, ripper or scraper. Convenience makes it easy to choose the right speed at the right moment.

Matching this ease of control are safety features you'll like. A safety lock in the selector housing holds a parked machine in neutral while the engine is running. Another safety device automatically shifts the selector lever to neutral when the engine is stopped.

The simplicity and safety of the Cat power shift transmission make your good operators even better and less experienced operators more effective. They can take greater advantage of the tractor's power and capacity to speed the work. And ease of operation keeps their efficiency high throughout the day.

Cat power shift transmission also means a big jump in your machine's efficiency too. You'll particularly notice the difference on jobs where frequent shifting is the rule—such applications as feeding a shovel or short-cycle dozing.

For instance, in dozing, the operator starts to pick up the load in second gear—then shifts on the go to first for full lug yardage. There's no clutching, no lost time or momentum when changing speeds. An easy move back to second drifts the material to its destination. Another move of the lever puts the machine in high-speed reverse for fast return to the digging area.

Machine efficiency is *always* high. Cat power shift transmission provides the needed power at the highest possible speed. Its exclusive torque divider design combines the snap and economy of direct drive with the load-matching ability and anti-stall characteristics of torque converter drive—and three forward-reverse speeds tailor it to the entire working range.

Just how much of an increase will the Cat power shift transmission make on your job? This will depend on your application. On short-cycle dozing, reports in our file show increases *as high as 50%* over similar-sized machines with other transmissions. Some users flatly state they will never buy another track-type machine in the 200 HP class unless it is a Cat power shift unit.

Power shift transmission is just one reason the D8H may be a far better profit tool than the machine you are now using. There are other features of this 235 HP turbocharged tractor that could be equally advantageous in your work. Your Caterpillar Dealer will welcome the opportunity to discuss the D8H in terms of your job and present facts and figures so you can determine true benefits. And if a demonstration with measured results would help, he will be glad to make arrangements.

Call him today.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

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STEP UP PRODUCTION AND PROFITS WITH POWER SHIFT TRANSMISSION

GOODYEAR

Q: What do Goodyear Earthmover Rims have that no others have?

A: MORE times FOUR

1. MORE rims on the job: More tons are hauled on—more earth-moving equipment rides on Goodyear rims than on any other kind. Result: You reap the benefits of the widest, soundest experience in rim design, manufacture and use.

2. MORE kinds of rims: Maximum rim performance stems from proper specification. Goodyear makes the *only complete line* of earthmover rims. Result: The choice that permits you to get exactly the right rim for the job.

3. MORE rim engineering help: Goodyear has more engineers designing *and selling* rims than any other company. And they know tires, too. Result: The help you need in choosing the right rim for top performance—longer tire life.

4. MORE rim "firsts": The first *true* earthmover rim, the first 5° rim, the first tubeless rim—in fact, every major earthmover rim advance was made by Goodyear. Result: The very latest in rim design and manufacture at work, for you.

What better reasons for choosing Goodyear as your rim supplier? Only these: The desire and ability to design and build any rim that may be needed for *tomorrow's* earth-moving equipment. No matter what your rim needs or plans, you'll find it pays to call on Goodyear. See your local rim distributor, or write: Goodyear, Metal Products Division, Akron 16, Ohio.

Lots of good things come from

GOODYEAR

25-ton payloads . . . yet off-highway trucks average 4 to 6,000 hours before overhaul

For the past four years, six Euclid 36 TD dump trucks have played a key part in Mountain Copper Co. of California's open-pit mining operations near Redding. Using RPM DELO Supercharged #3 Oil, this fleet has already worked more than 40,000 hours without a lubricant failure.

Operating conditions are tough for the "Eucs"; put a real strain on their engines. Hauling iron pyrite ore to the crusher plant and removing waste (above), they must travel loaded down 7% grades. Payloads range up to 25 tons . . . dust is thick . . . and temperatures reach 105° for six months of the year. Despite all this, the trucks work from 4,000 to 6,000 hours before engine overhaul.

"We have no wear problems at all using RPM DELO Supercharged #3," says Master Mechanic Ben Jacklin. "Never had any lubrication trouble in any engine using it. The oil's done an outstanding job in our equipment."

RPM DELO Oils reduce wear and prolong engine life because they cling to parts whether the engine is running or idle. Anti-oxidant fights gum and lacquer formation, special detergent keeps parts clean. Other additives prevent corrosion, crankcase foaming.

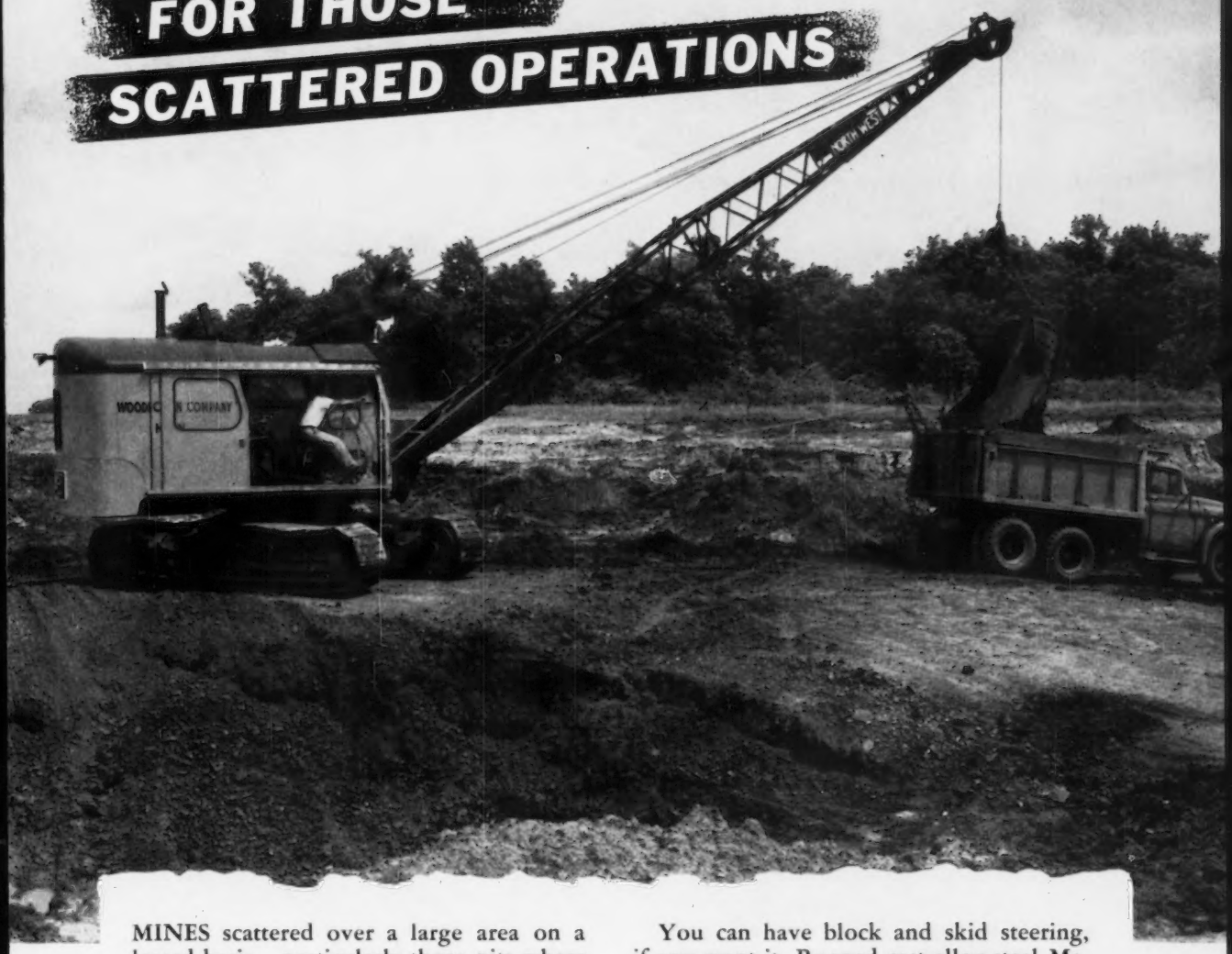
Why not try RPM DELO Oils? Let them cut your costs, lengthen equipment life. Just call your local representative, or write any company listed below:

LUBRICATING OILS RPM DELO

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • **STANDARD OIL COMPANY OF TEXAS,** El Paso
CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey - Denver, Colorado

TRADEMARK "RPM DELO" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

THE RIG FOR THOSE SCATTERED OPERATIONS



MINES scattered over a large area on a leased basis — particularly those pits where a land owner limits output because of taxes — present a problem. Here is just such a situation — an iron mine — one of several leases in Minnesota. The Model 6, 1½ yd. Northwest is working on contract, handling the stripping and mining of ore which comes in thin lenses charged with mud, sand and ochre.

As country roads are used by the ore trucks in the haul to the washing plant, the Model 6 jumps from mining to road maintenance and builds good public relations by keeping the roads in better shape than local maintenance crews. Such a machine can easily move from pit to pit.

The Northwest Dragline is ideal for a job like this. Positive Traction on both crawlers, while turning as well as when going straight ahead, takes it smoothly through the varied conditions this class of work always presents.

You can have block and skid steering, if you want it. Rugged cast alloy steel Machinery Bases and Machinery Side Frames eliminate constant rebuilding. Swing Clutches are larger. They are Uniform Pressure Clutches and need no fans or special cooling devices. Smooth, jerk free swings bring greater accuracy to spotting loads and reduce spillage when loading. The Feather-Touch Clutch Control makes operation easy and gives the "true" feel of the load. There's the Cushion Clutch, 3rd Drums for an extra line in pile driving and many other advantages that bring versatility to the small mining job. Ask about Northwest before you buy.

NORTHWEST ENGINEERING COMPANY
1509 Field Bldg., 135 S. LaSalle Street, Chicago 3, Illinois

D-6-11-L

NORTHWEST
CRANES • SHOVELS • DRAGLINES
PULLSHOVELS • TRUCK CRANES

3/4 to 3 Cu. Yd. Capacity

11000 turbocharged diesel engine—conservatively rated at 184 hp, features Allis-Chalmers unique controlled turbulence principle that gives you more work power for less fuel dollar.

New ARROWHEAD cutting edge—provides longer life and adds protection and strength for the bucket bottom and side plates.

Safe, sure air brakes—four-wheel air brakes let you work with confidence on the steepest grades and stockpiles. If air pressure should fall below 55 psi, an interrupter in the horn circuit warns the operator in plenty of time to make necessary adjustments.

Full box frame—soaks up stress and strain . . . offers outstanding balance and stability . . . permits efficient equipment mounting.

NEW TL-30

184 hp
10,500-lb carry capacity
2½- to 6-cu-yd buckets
Weight: 28,400 lb

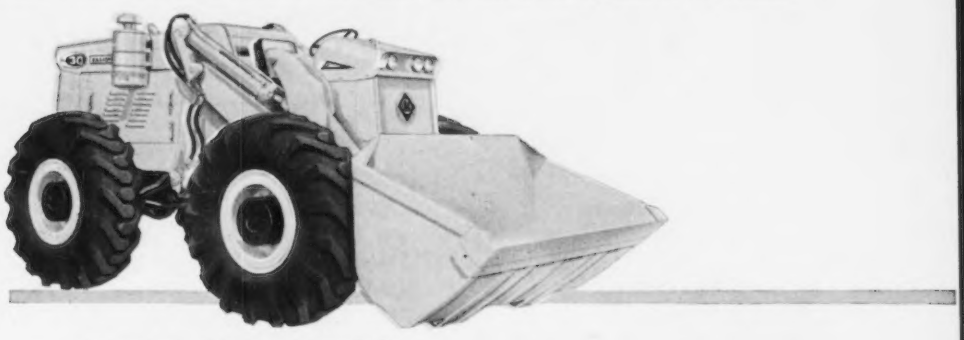
Best power and capacity in its size range

The new Allis-Chalmers TL-30 will give you more production than any other loader in this class. Its modern 11000 turbocharged diesel delivers 184 hp . . . up to 13 percent more power than others its size. This high-power output is delivered by a combustion system that has established itself as the most efficient in the industry. Proved in other Allis-Chalmers engines, this controlled turbulence, open combustion chamber design, gives you thorough mixing of air and fuel for complete, fast and even combustion . . . high fuel economy.

When it comes to carry capacity, the new TL-30 sets the pace in the industry. It carries up to 10,500 lb . . . a big 16-percent bonus over other loaders in this size range. This extra capacity lets you increase material flow . . . reduce handling costs on every shift.

The new TL-30 also features the same exclusive design and construction advantages in other Allis-Chalmers tractor loaders. Single-lever control; high dumping clearance and long reach; pin-connected axles; 5-way hydraulic filtering protection; safe dump cylinder location and added loader stability are some of the reasons why Allis-Chalmers tractor loaders have received tremendous acceptance by contractors, road builders and public officials around the country . . . in fact, around the world.

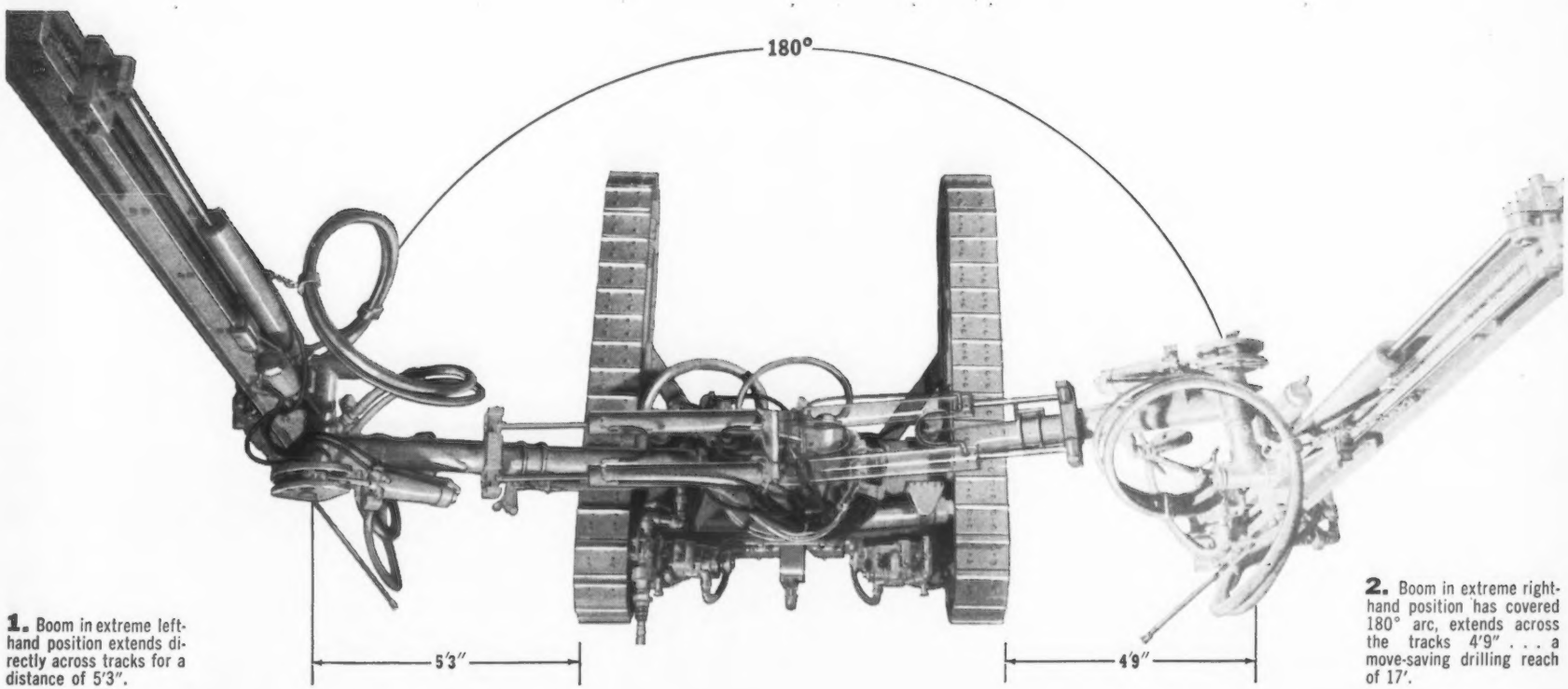
Before you decide on your next loader, make sure you get the complete story on the new TL-30, plus information on the other five tractor loader models—from 77 to 130 hp . . . 3,600 to 9,000-lb carry capacities. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.



move ahead with

ALLIS-CHALMERS

. . . power for a growing world



1. Boom in extreme left-hand position extends directly across tracks for a distance of 5'3".

2. Boom in extreme right-hand position has covered 180° arc, extends across the tracks 4'9" . . . a move-saving drilling reach of 17'.

TRACDRIL'S 180° "BOARDING HOUSE REACH" PAYS-OFF!

More and more mining men are discovering that with the full 180° ground coverage of the G-900 Tracdril fewer moves are needed . . . that more blast holes can be drilled from every set-up.

In addition to the time-saving advantages of their 180° "Boarding House Reach", new G-900 Tracdrils have already gained an outstanding reputation for:

- Extra-long crawlers, 1350 sq. in. ground contact and knee-action . . . that take bad footing in stride.
- Remarkable ability to shift from straight verticals . . . to high horizontals, 11 feet at the face . . . or to snake holes at ground level.
- The time and step-saving advantages of two sets of grouped controls . . . one at turret, one at boom end.
- Heavy-duty brakes that lock and hold automatically the instant tramming throttle is released.
- You'll want a copy of Bulletin SP-3267 for G-900 specs, operating diagrams and dimensions. Write to:

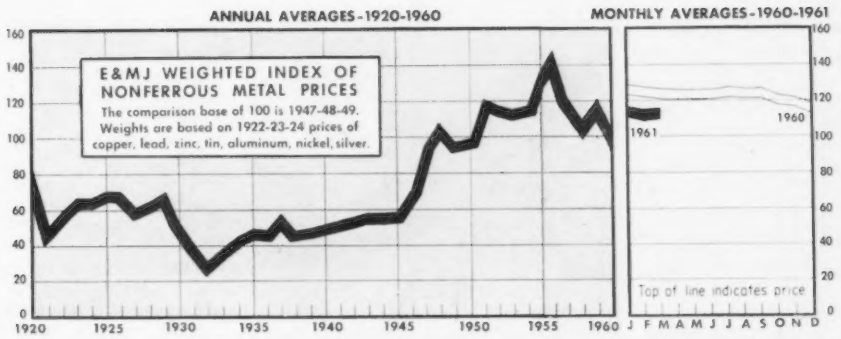
Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

PORTABLE AIR COMPRESSORS • PNEUMATIC and ELECTRIC TOOLS
REICHdrills • THREE-CONE AIR-BLAST BITS • ROCK DRILLS

E&MJ OUTLOOK

PRICES


ANNUAL AVERAGES - 1920-1960
MONTHLY AVERAGES - 1960-1961
E&MJ WEIGHTED INDEX OF NONFERROUS METAL PRICES
The comparison base of 100 is 1947-48-49. Weights are based on 1922-23-24 prices of copper, lead, zinc, tin, aluminum, nickel, silver.
1961
1960
Top of line indicates price
J F M A M J J A S O N D

MARKETS

The slight rise in E&MJ's nonferrous metals price index from 115.2 in February to 115.4 in March is attributable solely to the mild increase in the tin price. All other metals were unchanged.

•

World lead producers have until May 15 to indicate a willingness to cut back production, and subsequently take part in a U.S. barter program. U.S. representatives at the Mexico City meeting last month promised that if cutbacks were undertaken by individual companies, not governments, lead would be added to the barter list and exchanged for surplus U.S. agricultural products. (See Markets, p22.)

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AT HOME

World nickel requirements for 1961 are expected to equal, and possibly exceed, the Free World total of about 515-million lb, according to estimates by Henry S. Wingate, chairman, and J. Roy Gordon, president of International Nickel Co. Last year Inco purchased 51.4-million lb of surplus U.S. stocks for resale at no profit to consumers. This year the company estimates that it will purchase an additional 40-million lb to help the U.S. Government liquidate surpluses above strategic requirements. This will also assure industry that surpluses will not be released at a future time to disturb orderly nickel markets.

By year-end, Banner Mining Co. expects to be hoisting 1000 tpd of copper ore from its new five-compartment shaft in Arizona's Pima District. Some 400 tpd of development ore is being hoisted now, and the shaft is bottomed out at 960 ft. Development of 700, 800 and 900-ft levels is being speeded, in spite of excess water, which hampered shaft sinking and prevented sinking to the planned depth of 1000 ft.

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LABOR

Mine-Mill has re-opened its Washington office and is furnishing it with a raft of legislative hopes, including a proposed cut in lead-zinc imports.

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ABROAD

Chile's Institute of Geological Investigations (equivalent of USGS) will soon be reporting on the Mamina area of Tarapaca Province, where geologic evidence indicates the possibility of another huge copper orebody. The government has claimed the area until investigations are completed, at which time, if an orebody is found, private interests will be invited in.

Discussions are continuing between Britain's Atomic Energy Authority and Canada's Eldorado Mining and Refining Co. concerning the purchase of 12,000 tons of uranium. The discussions, which are considering "major adjustments" date back to 1957, pre-dating what AEA calls "changes in the U.K. nuclear power program."

THIS MONTH IN MINING

International Technical Coverage Stressed at AIME Convention

MORE THAN 400 PAPERS were listed on the program of the American Institute of Mining Metallurgical and Petroleum Engineers annual convention held in St. Louis Feb. 26-March 2. In keeping with the curent trend toward a more fluid international exchange of technical information, papers were contributed from Canada, Mexico, South America, Britain, West Germany, France, Israel and Japan.

Also of international significance was the installation of Ronald R. McNaughton, of Trail, British Columbia, as president of AIME. McNaughton is the first Canadian citizen to achieve this distinction in the 90-year history of the AIME. Outgoing president, Dr. Joseph Gillson, cited this as evidence that Canadian and U.S. mining engineers do not regard the 49th Parallel as a barrier to the mutual exchange of technical information, nor to the mutual participation in programs to advance the status of the mining engineering profession.

New presidents installed in the member societies of the AIME were: James C. Gray, of Pittsburgh, Society of Mining Engineers; J. S. Smart, Jr., general sales manager, American Smelting & Refining Co., the Metallurgical Society; and Earl M. Kipp, of San Francisco, Society of Petroleum Engineers.

Authors were freer to release costs than in former years. For instance, in a paper, "Electric Study at the Berkeley Pit," by Richard Stewart, of Anaconda's mining research department, the following preliminary costs estimates for various types of truck haulage equipment were given:

Unit	Length of haul miles	Grade %	Cost per ton cents
450-hp straight diesel	1.0	4.5	7.963
700-hp straight diesel	0.68	8.0	6.973
TR 60/335 straight electric	0.48	15.0	5.038
TR 60/670 straight electric	0.48	15.0	5.592

The foregoing were for loading conditions with a 6-yd shovel. It was estimated that if a 10.5-yd shovel were used to speed up loading, the haulage costs per ton would be as follows:

Unit	Length of haul miles	Grade %	Cost per ton cents
TR 60/670 straight diesel	0.48	15.0	4.307
700-hp straight diesel	0.68	8.0	6.284

The TR-60 is a 4-wheel prototype of the R. G. Le Tourneau straight-electric wheel rear-dump, 60-ton, semi-trailer unit tested at the Berkeley pit. Figures 335 and 670 designate horsepower of the trucks.

Ronald L. McNaughton

Costs of converting saline water to fresh by various processes were listed in a paper, "Saline Water Conversion Economics," by V. C. Williams, as follows:

Type of plant or process	Plant cost dollars per daily gal	Water cost dollars per 100 gal
Distillation	1.00	0.95
Flash distillation	1.35	1.90
Vapor compression	3.00	1.55
Freezing	0.85	0.52
Electrodialysis	1.10	0.40

The above costs apply to a U.S. Gulf state location for a 10-million gpd plant with sea water as a feed (except for the dialysis unit where feed is designated as 4,000 ppm salt.)

Process water required for the production of various metals and chemicals were listed as follows:

Product	Water, gal per ton of product
Aluminum	350,000
Steel	65,000
Explosives	200,000
Ammonia	30,000

Average revenue per ton of material hauled by Class I railroads and Class I motor carriers in the U.S. for the year 1958 as reported by the Interstate Commerce Commission was listed as follows in a paper "Transportation Economics of Mineral Commodities," by William Riggs, of Gulf, Mobile and Ohio Railroad Co.:

Commodity	Average revenue per net ton in dollars: By rail	By motor carrier
Iron ore	2.39	1.02
Aluminum ore	7.69	16.95
Copper ore and conc.	0.74	5.08
Lead ore and conc.	3.81	3.48
Zinc ore and conc.	7.01	5.08
Barytes	6.59	3.78
Phosphate rock	2.34	8.12
Sulphur	3.76	3.33

Although the foregoing figures do not indicate ton-mile costs because some commodities are hauled over greater distances than others, they do give a rough idea of the amount that freight adds to the costs of metals and minerals processed for sale on the market.

Copper Poling is Out — Several techniques which might be classified as revolutionary were presented in metallurgical papers. In "Gaseous Reduction of Oxygen-Containing Copper," by Leonard Klein, research chemist, Phelps-Dodge Corp., a process was described in which the old cumbersome process of refining copper with wooden poles is replaced by a reducing process using natural gas reformed with air. Total cost for power and gas for gaseous refining was 8.08c per ton, while the cost of poles for wooden poling was 64.5c per ton. Overall savings have not been estimated to date because of lack of information on maintenance and repair costs.

Oxygen in Zinc Roasting — "Uses of By-Product Oxygen in Roasting Processes at the Electrolytic Zinc Co. of Australia in Tasmania," was the title of a paper by R. W. Pickering and D. J. Gaffney. By-product oxygen from the company's hydrogen cells and liquid air plant is introduced in multiple-hearth roasters to reduce the sulphide sulphur content of the calcine and increase the capacity of the furnace.

Educational Session — An opening session on mining education which drew a good audience of educators and members of industry was unusually productive in that it sharpened some of the issues that have been perplexing the industry for many years. A summary of industry and educator's viewpoints plus a firsthand report of what industry specifically expects of mining graduates will be published in detail in a subsequent issue of E&MJ.

Four-Nation Concord Will Tap Liberian Fe

A COMMITMENT of $30-million loan from the Export-Import Bank last month is acting as a trigger for the development of a $200-million iron ore project

in Liberia's Nimba Mountains. Liberian, Swedish, West German and U.S. interests are combining to open up the deposits, which are set at 235-million tons proven and another 500-million indicated.

Initial production is to be 6-million tpy, with eventual expansion to 10-million. Some 2.5-million tpy is already contracted for by West German plants. Other tonnages will go to Bethlehem Steel Co., a one-fourth owner of the Lamco Joint Venture.

In its coverage of the announcement of the go-ahead of the project, the NEW YORK TIMES noted that the government of Liberia is functioning in the operation, not as a collector of taxes and royalties, but as a major stockholder in the venture.

New House Bill Calls for Mineral Resources Dept.

CREATION OF A U.S. DEPARTMENT of Mineral Resources to be headed by a Secretary of Mineral Resources with cabinet status is called for in bill H.R. 2210 introduced by Rep. Walter Baring (D., Nev.) early this year. The bill could establish four departments, each to be headed by an assistant secretary: (1) Coal, (2) petroleum and natural gas, (3) metal and non-metallic minerals, and (4) mineral patents and leases.

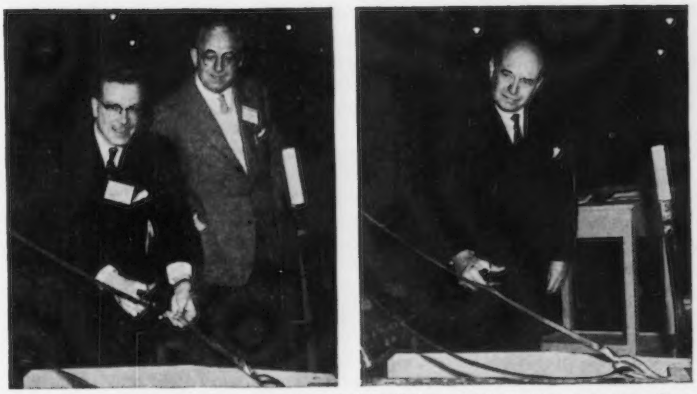
All functions vested in the Secretary of Interior which relate to minerals and mineral resources would be transferred to the Secretary of Mineral Resources. Similarly all functions of the Defense Production Act relating to minerals and mineral resources would be exercised through the new department.

The following agencies would be subject to administration by the proposed departments: Division of Minerals and Fuels, Oil and Gas; the Bureau of Mines; U.S. Geological Survey; Defense Minerals Exploration Administration; such portions of the Bureau of Land Management relating to mineral patents and leases, including coal, oil, gas and nonmetallic minerals; and the Defense Mineral Procurement Agency in the General Services Administration.

For more than a year, officials of major steel and nonmetallic mining companies have been discussing the need for a separate government department of minerals. It has been argued that the Department of the Interior cannot do justice to the farmer, cattleman, lumber industry, outdoor sportsman, and the miner, all competing for government lands to develop their respective interests. Others have said that the mining industry is as much entitled to a full-time secretary championing the interests of mining, as the agriculture industry with its Secretary of Agriculture. Right now it is felt that mining needs a cabinet officer to oppose so-called wilderness legislation.

(*News continues on p 114*)

As We Went to Press . . .



HONORABLE DUFF ROBLIN, premier of Manitoba, (left) J. Roy Gordon, Inco president, and Henry S. Wingate, chairman, cut nickel ribbon at Thompson.

International Nickel Co. of Canada, Ltd., dedicated its new Thompson project in northern Manitoba on March 25. (See pp 92-94.) Hon. Duff Roblin, premier of Manitoba, Henry S. Wingate, Inco chairman, and J. Roy Gordon, Inco president, officiated at the cutting of a nickel ribbon attached to a nickel shearing machine which signalled the start of production of refined nickel for market. Other speakers included Hon. Paul Comtois, Canadian minister of mines, Hon. Charles Whitney, minister of mines and natural resources of Manitoba, Walter Dinsdale, Canadian minister of northern affairs and natural resources, and Robert Simpson, member of parliament from the Churchill district.

The project is named in honor of Dr. John F. Thompson, honorary chairman of Inco, who prior to his retirement in 1960 served the company for 53 years. Dr. Thompson presented a commemorative plaque to the people of Thompson, commending the citizens of the new townsite for their participation in a pioneering project which he predicted would be a source of pride to present and future generations.

By the end of 1961 total ependitures by Inco for power facilities, mine, plant, townsite and first-year operating costs will total approximately one-quarter-billion dollars.

Mr. Wingate praised Ralph D. Parker, senior vice president, and J. C. Parlee, vice president in charge of the Thompson project, and their associates for the competent manner in which the project was brought into production on schedule.

The AEC completed its 1962-1966 uranium concentrates purchase contract with Trace Elements Corp., Maybell, Colo., subsidiary of Union Carbide Nuclear. This is one of the series of contracts that AEC is wrapping up in the procurement "stretch-out."

The Commission will purchase some $20.7-million worth of concentrates in the extension period.

International Minerals & Chemical Corp. completed its "tubbing" job in the potash shaft at Esterhazy, Sask. in late March. IMC's pilot plant is almost completed, and ready to produce some 420,000 tpy of product, with twice that capacity due to be built.

WASHINGTON IMPACT

Highlights

CONGRESSIONAL SPONSORS OF LEGISLATION designed to help U.S. producers of lead and zinc are beginning to show a distinct lack of optimism over their chances for success this year.

The two leading proposals in this area are a subsidy bill sponsored in the House by Rep. Ed Edmondson (D., Okla.) and others, and an imports tax measure pushed mainly by Rep. Wayne Aspinall (D., Colo.), chairman of the House Interior Committee.

Edmondson, whose bill is backed in the Senate by Sen. Robert S. Kerr (D., Okla.) and other mining-state lawmakers, would aid smaller lead and zinc producers by establishing stabilization payments to make up the difference between actual sales prices and a market price of 17c for lead and 14.5c per lb for zinc. Producers who had an annual output of not more than 2,000 tons of the metals would be eligible; first-year cost of the program would be an estimated $4.8-million.

Aspinall prefers another approach—a new system of import taxes on the two metals to pay for Federal subsidies to smaller lead and zinc producers. He would replace present tariff duties on lead and zinc with permanent import taxes of 2c per lb on metal and 1.4c per lb on ores and concentrates.

But both Edmondson and Aspinall have reached the point of almost conceding—even publicly—that their bills have little chance of adoption unless the Kennedy Administration supports them. And, so far, there is no indication that the Administration is willing to buy either approach. Of the two, Kennedy mght be under more pressure to support Edmondson's direct subsidization measure; an identical Edmondson-Kerr bill was passed by Congress last year but vetoed by President Eisenhower. Kennedy, during the 1960 campaign, said he would have signed the bill. Now it appears that he wants some new, broader approach to lead and zinc problems.

EDMONDSON SO FAR has not been able to pin down Interior Department officials on his bill. He had scheduled testimony on the bill last month by Assistant Interior Secretary John Kelly, but Kelly and other Interior officials failed to show up, saying they still had some figuring to do on the cost aspects of the Edmondson proposal. There were indications, though, that the Administration representatives did not care to be tied down on lead and zinc policies until after last month's world lead-zinc meeting in Mexico City was held and the developments weighed in Washington.

Meanwhile, labor witnesses testifying on the Edmondson bill show some divergence in their ranks. A spokesman for the United Steel Workers of America said the union favored direct subsidies as a quick means of putting unemployed miners, mill workers and others back to work. But a witness from the International Union of Mine, Mill and Smelter Workers said Edmondson's bill could have some adverse effect, that increased subsidized production could cause further lowering of prices and perhaps result in cutbacks and layoffs of workers in non-subsidized mines. The union proposed instead that a subsidy program for all mines be considered.

A SENATE STAFF REPORT calls for a new national minerals policy which would mean "keeping in production the more efficient mines—but only the more efficient mines."

The staff of the Senate Interstate and Foreign Commerce Committee, in a report not formally approved by the committee members, found U.S. policy tending to "aid the more and less efficient mines alike."

"The problem is to find a tariff level which, in the long run, will keep only the better mines alive," the report said. It suggested the authorization of subsidies low enough to insure that more mines will not be encouraged to enter production, and also insure that no windfall profits accrue to firms which do not need subsidies to survive.

"While certain hazards are involved," the report said, "a modest subsidy program is preferable to burdening the whole of American industry with high raw materials cost which hobble our ability to compete."

Commodity Agreements Are Eyed by Kennedy

PRESIDENT KENNEDY has indicated that commodity agreements might be used to facilitate U.S. trade, particularly with Latin American countries.

Kennedy proposed a new, multi-billion economic development program to help raise and stabilize the Latin economies. He said the U.S. is ready to cooperate in "serious, case-by-case examinations of commodity market problems."

"Frequent violent changes in commodity prices," he said, "seriously injure the economies of many Latin nations—draining their resources and stultifying their growth. Together we must find practical methods of bringing an end to this pattern."

Washington observers think Kennedy might run into Congressional trouble on any proposed commodity agreement affecting metal and mineral production, unless domestic producers could be assured of holding their share of the market if not bettering it.

There is a question whether Kennedy could enter into such agreements, under his broad executive powers, without the consent of Congress. In any event, Kennedy probably would bring Congress into the picture to avoid any retaliatory, countermanding legislation.

Grand Jury Will Check "Similar" Brass Prices

A FEDERAL grand jury investigation of the copper-brass industry is expected to concentrate initially on brass products pricing in New England.

Justice Department officials say they cannot be sure, at this stage of the investigation, whether the action will be extended beyond the production and marketing segments of the country.

Much will depend upon what evidence is uncovered during the early days of the probe, which will get under way in Hartford Conn., this month.

The grand jury is being convened in Hartford by Federal District Judge Robert P. Anderson, who acted upon request of John J. Galgay of the Justice Department's New York office. Galgay is expected to work with a group of antitrust attorneys from Washington in guiding the investigation.

Washington sources stressed that the investigation will be "broad" but declined to pinpoint the type of antitrust violations they may allege.

But there were strong indications that the bulk of the investigation will center on similar pricing for brass products. If the grand jury finds grounds for returning indictments the statute at issue probably would be the Sherman Act. Section 1 of the Act forbids "conspiracy in restraint of trade . . ."

Meanwhile, Justice officers are preparing for the investigation by subpoenaing

witnesses, files, and documents. Several major copper companies and brass fabricators are expected to be involved.

Senate Approves U.S. Entry Into OECD

THE SENATE has authorized U.S. participation in a new, 20-nation Atlantic Community to be called the Organization for Economic Cooperation and Development.

OECD membership for the U.S. was first proposed by the Eisenhower Administration, then backed by President Kennedy.

Administration officials say OECD will assure the U.S. a forum for discussing mutual trade problems with European and Atlantic nations and will help avoid any pinch on the U.S. if Europe's two trade blocs merge.

Some protectionist groups opposed OECD membership, claiming the organization would interfere in U.S trade policies and result in higher degrees of competition for U.S. industries.

Justice Dept. Opposes Copper Control Pacts

THE JUSTICE DEPARTMENT is frowning on proposals for world-wide arrangements on copper pricing and production.

Department officials indicate privately they would oppose any action by U.S. copper companies to participate in such a program as proposed by the Chilean government. Chile wants a number of major copper companies to act in concert to stabilize the copper market.

Justice reportedly is warning U.S. copper companies that to join such an agreement would be in violation of antitrust laws.

A proposal by Senate majority leader Mike Mansfield (D., Mont.) that some international agreement be reached on copper—"a cartelization of sorts"—also is believed to be opposed by the Justice Department.

Mansfield had conceded in his original proposal for a world conference on such an agreement that it might run into antitrust difficulties, but indicated he felt sufficient immunity from prosecution could be given.

Unification of Aid

DONATIONS to foreign countries from U.S. stockpiles would be switched to a new, broad aid agency under President Kennedy's new foreign aid program.

Kennedy would lump together all U.S. aid groups into a single administration, including the International Cooperation Administration, the Development Loan Fund, Food-for-Peace program, local currency lending of the Export-Import bank, and the Peace Corps.

Labor This Month

WHITE HOUSE ADVISORY TEAM TACKLES AUTOMATION: There are twenty-one minds against the machine as President Kennedy's labor-management advisory committee searches for answers to structural unemployment caused by automation—particularly in such industries as steel, coal, automobiles and airplanes. The task force of labor-management and public representatives meets this month, and the first Monday of each month thereafter, to discuss and seek solutions to the complex issues of wages and prices, threat of foreign imports, collective bargaining climate and a host of other troublesome problems. First on the agenda is automation, how to foster it and at the same time protect the workers who lose out to the machine.

This, says Labor Secretary Arthur Goldberg, who devised the committee approach, is a "new experiment. It is unlike any other labor-management conference." Obviously wary of the pitfalls that befell other such conferences in the past, the Administration has adopted a go-slow approach and has laid out what it hopes are safe ground rules. 1) The committee will aim for recommendations to the President by "consensus" —no resolutions by majority vote; 2) members represent themselves and not vested interests—no proxies or substitute members are allowed; 3) to assure free and open discussion no transcript will be kept of the meetings; 4) the committee will not step into specific labor-management disputes. The latter is aimed at avoiding divisions within the committee. One obvious trouble-spot: with the critical auto industry negotiations about to open up, two members of the committee are Walter Reuther and Henry Ford II.

MINE-MILL GOES TO WASHINGTON: With a hefty package of legislative aims—topped by unemployment cures and curbs on lead and zinc imports—the Mine, Mill and Smelter Workers union has re-opened its Washington office. It will be a permanent lobbying headquarters for the Denver-based union, headed by Horace White, MMSW's international representative. At the union's national convention in Tucson, Ariz. late this month, Mine-Mill leaders will promote a per capita tax increase from members to help offset the costs of the Capital office.

INDUSTRIAL UNIONS EYE SOUTHERN MEMBERS: The AFL-CIO's industrial union department has quietly opened new organizing headquarters in the Spartanburg-Greenville, S.C. area. This is the first joint union organizing thrust in the South since the abortive "Operation Dixie" campaigns a decade ago. More than a score of industrial unions are joined in the program, with the first goal the non-union textile firms. No fanfare accompanies this campaign.

AFL-CIO officials anticipate some outside help. They're watching the first decisions of the NLRB, which now has a Democratic majority with two new members appointed by President Kennedy.

The unions want the newly-staffed board to tighten restrictions on employers seeking to avoid unionization of their workers. If they succeed, they'll give their organizers the go-ahead signal.

TEAMSTERS' HOFFA TIGHTENS EMPIRE: Moving towards full control of the 1.7-million member union—to be completed with his re-election at the Teamster National convention in June—James A. Hoffa is shucking all alliances with other unions. During Hoffa's period as provisional president under supervision of court-appointed monitors, he talked of aligning with other independent unions. These included Mine-Mill, the United Electrical Workers and the Longshoremen's and Warehousemen's Union. This is now out the window.

AUTOMATION BARGAINING COMES OF AGE: The United Rubber Workers lay out "age of automation" demands for late spring bargaining with the big four rubber manufacturers. The key goals: a shorter workweek, earlier retirement, limits on overtime work to "unusual and essential situations," first hiring rights at new company plants, severance pay for laid-off workers and improved supplementary unemployment benefits. The final demand in an 11-point program is a jointly-administered automation fund to help reach the union's goals.

MARKETS

Production Cuts, Barter Bolster Lead Market; Aluminum Stocks Rising; Copper, Zinc Firmer

THE E&MJ INDEX of Nonferrous Metal Prices gained .2% in March to 115.4% of the 1947-49 average owing to a near 2½c rise in the price of tin. The other more heavily weighted metals were unchanged from February. The E&MJ Index of Metal Use, adjusted for seasonal variation, is estimated at 101% of the 1950 average. The February preliminary is 100%, the same as the upwardly revised January final.

Delegates to the recent (ended March 24) meeting of the International Lead-Zinc Study Group in Mexico City came away with the feeling that for the first time since the organization's inception something had been done to firm the lead market.

Leading world producers have agreed to curtail output at least 2% below 1960's production. (ABMS's Free World output figure for 1960 was 1,616,455 tons.) Demand is expected to rise 3% this year. The combination of cutbacks and increased demand is expected to reduce stocks to manageable amounts.

In another move to improve the international lead situation, the U.S. Government has offered to barter surplus agricultural products for lead. The latter would be stockpiled. The offer applies only to stocks accumulated before Jan. 1, 1961, and participants must agree to cut 1961 output below 1960 levels. Acceptance must be indicated by May 15. U.S. Government officials have made it clear that the offer will not be made again. Australia and Canada were among the first producers to show interest.

Delegates polled at the meeting felt that the lead emergency was so great that member countries this time would observe cutbacks. "We really think there will be a fairly rapid firming up of lead prices now," one delegate said. "If prices firm up too much and too fast, there are built in safeguards for putting lead stocks on the market right away," he explained.

No action was taken on zinc at the Mexico City meeting. U.S. officials pointed out that a balance of world supply and demand is maintained only because the U.S. is a net importer of 100,000 tons of zinc annually, but other countries were not listening.

With the publication of zinc statistics early in the month, the market gave signs of weakening. U.S. stocks rose about 8,600 tons—all of it Special High Grade—pointing up a slowdown in automotive demand. Observers were predicting further and larger curtailments to protect the 11½c price.

By the end of the month, however, sales had climbed sharply and numerous observers had revised their opinions. Good call by galvanizers sparked the resurgence. March sales easily surpassed those of February and compared well with any month of the past year.

Cutbacks and the potential loss of large chunks of output in African producing centers continued to give the copper market a firm undertone.

The biggest news was the domestic market where sales picked up sharply and eliminated chances of a custom smelter price cut. In fact conditions were so completely reversed that rumors of a higher price commenced. The idea was temporarily dismissed by various sellers at the end of the month, but consumers were no longer as easily able to get short-notice 29c material. Merchants sold some copper at 29c but were asking more. London averaged £225.278 (28.16c) in March, £1.7 higher than February.

A Chilean dock strike in March, lasted nearly three weeks, gave added support to the market. Production there by Anaconda and Kennecott was not disturbed, but shipments of metal and ore were far behind schedule.

The Chile Copper Department announced that it was considering use of a managed selling price, possibly between 28-33c a lb, in preference to presently used LME quotations. The idea is to eliminate sharp price fluctuations and rid prices of speculative influence.

Talk of a 1961 tin shortage began with word that output in the Congo had been completely shut off. The news compounded an already delicate supply-demand balance, and convinced sellers that prices would move up. They did just that with N.Y. jumping about 2½c an London rising about £22 to £814½ (101.8c) for the month. Heavy seasonal buying by U.S. platers added to the month's bullishness.

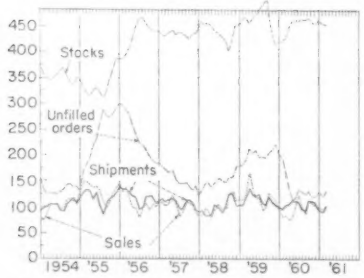
The International Tin Council met in London in March, and as predicted decided to maintain a quota-free market through the second quarter.

Stocks of primary aluminum at the end of January surged nearly 32,000 tons. Despite cutbacks that dropped output to about 73% of capacity in February, the industry has had no luck in limiting stock accumulation. Output in February was 138,560 tons, the lowest since September 1958.

Olin Mathieson has developed a new process which makes it commercially practical to produce alumina from common clay and will make it possible to produce aluminum where cheap power exists without having to compromise on location of raw material.

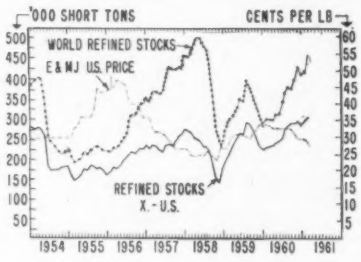
Market opinions are divergent. Late in the month one company official noted improved orders. Another forecast that overcapacity and idle facilities were conditions that were not likely to change in the near future.

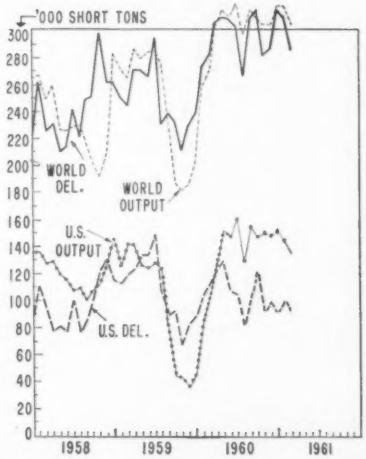
U.S. Copper Fabricator Data



Data in thousands of short tons from U.S. Copper Assn. The sales and shipment series are related only to purchases of refined copper by the fabricators, including copper refined by custom smelters from their intake of scrap and concentrates. All statistics refer to brass mills, wire mills and foundries. All series are for fabricated products except stocks which are of refined copper and copper in process. February is the last month indicated. Sales and shipments series are two months moving averages.

Copper Production and Stocks





Data, except price, are from the Copper Institute and are in thousands of short tons. They include February 1961. World refined output and stocks do not include the U.S.S.R., Japan, the Scandinavian countries, Yugoslavia, and the Mesina Mine in Transvaal. The series "X-U.S." are the above world stock statistics less the U.S. No fabricator stocks are included. Beginning with Jan. 1960 the C. I. includes data for mines formerly excluded.

Average Prices March (E&MJ Quotations)

Cents per lb unless otherwise indicated:

Copper:	
Electro, domestic refinery	28.600
Electrolytic, exports refinery	27.303
Electrolytic, c.i.f. Cont'l ports	28.248
Lead:	
Common, New York	11.000
Common, St. Louis	10.800
Silver:	
Silver, New York, per oz.	91.375
Silver, London, pence per oz.	79.625d
Zinc:	
Prime, Western, East St. Louis	11.500
Prime, Western, delivered (g)	12.000
Tin:	
New York Straits	103,443
Gold, per oz, U.S. price	$35.000
Sterling Exchange	279.751
Quicksilver, per flask	$206.000
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony for, 99% (h)	25.560
Palladium, troy oz	$24.000
Platinum, refined, per oz.	$82.000
Cadmium (a)	150.000
Cadmium (b)	160.000
Al, 99½% unalloyed ingot	26.000
export, ingot	23.250
Magnesium, ingot	35.250
Nickel, (f)	74.000
Bismuth	$2.250
Cobalt	$1.500

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quick-silver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.
(h) 2c duty extra.

Free Gold Market

International gold dealing volume declined 7% during March. Coin and bar prices were fractionally lower in most European centers but were up somewhat in the Near and Far East. Coin trading remained active. Some small Soviet bar sales were reported from Switzerland. Gold futures transaction continued to decline, averaging less than $50,000 daily in London and Zurich. Interest rates listed at 4% p.a. against dollars and 3½% p.a. against Swiss francs. U.S. gold stocks rose $16-million, the first such move in two years and amounted to $17,389-billion. PICK'S WORLD CURRENCY REPORT quotes on "free gold" per fine oz as follows:

	Coins		Bars (12.5 kg)	
	Feb. 28	Mar. 31	Feb. 28	Mar. 31
New York transit	.....	.....	$35.10	$35.10
Manila	$41.25	$41.00	36.00	35.80
Hong Kong	48.30	47.60	40.25	39.85
Bombay	57.00	56.75	53.00	53.50
Beirut	40.50	40.65	35.32	35.25
Paris	40.50	40.00	35.35	35.35
Buenos Aires	41.70	41.35	36.10	36.25

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper

Based on flat price and E&MJ average price sales in U.S. for month of March reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ⅛¢; ¼¢ deducted for selling common.

Delivered consumer's plant . . 28.750 lb
F.o.b. refinery . . . . . 28.350 lb

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

Mar. 1961	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (e)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Unalloyed Ingot 99%	Straits Tin New York
1	28.600	27.650	28.595	11.000	10.800	12.000	11.500	26.000	101.625
2	28.600	27.400	28.345	11.000	10.800	12.000	11.500	26.000	101.625
3	28.600	27.450	28.395	11.000	10.800	12.000	11.500	26.000	101.875
6	28.600	27.325	28.270	11.000	10.800	12.000	11.500	26.000	102.250
7	28.600	27.375	28.320	11.000	10.800	12.000	11.500	26.000	102.625
8	28.600	27.425	28.370	11.000	10.800	12.000	11.500	26.000	102.875
9	28.600	27.350	28.295	11.000	10.800	12.000	11.500	26.000	103.125
10	28.600	27.175	28.120	11.000	10.800	12.000	11.500	26.000	103.125
13	28.600	27.125	28.070	11.000	10.800	12.000	11.500	26.000	103.375
14	28.600	27.125	28.070	11.000	10.800	12.000	11.500	26.000	103.875
15	28.600	27.175	28.120	11.000	10.800	12.000	11.500	26.000	104.000
16	28.600	27.200	28.145	11.000	10.800	12.000	11.500	26.000	103.625
17	28.600	27.250	28.195	11.000	10.800	12.000	11.500	26.000	103.750
20	28.600	27.300	28.245	11.000	10.800	12.000	11.500	26.000	104.125
21	28.600	27.350	28.295	11.000	10.800	12.000	11.500	26.000	104.000
22	28.600	27.300	28.245	11.000	10.800	12.000	11.500	26.000	103.875
23	28.600	27.325	28.270	11.000	10.800	12.000	11.500	26.000	104.250
24	28.600	27.425	28.370	11.000	10.800	12.000	11.500	26.000	104.625
27	28.600	27.250	28.195	11.000	10.800	12.000	11.500	26.000	104.375
28	28.600	27.200	28.145	11.000	10.800	12.000	11.500	26.000	103.875
29	28.600	27.175	28.120	11.000	10.800	12.000	11.500	26.000	104.250
30	28.600	27.275	28.220	11.000	10.800	12.000	11.500	26.000	104.625
31	28.600	27.350	28.295	11.000	10.800	12.000	11.500	26.000	Holiday
AVERAGES FOR MONTH									
Mar.	28.600	27.303	28.248	11.000	10.800	12.000	11.500	26.000	103.443
AVERAGES FOR WEEK									
Mar.									
1	28.600	27.675	28.620	11.000	10.800	12.000	11.500	26.000	102.050
8	28.600	27.395	28.340	11.000	10.800	12.000	11.500	26.000	102.250
15	28.600	27.190	28.135	11.000	10.800	12.000	11.500	26.000	103.500
22	28.600	27.280	28.225	11.000	10.800	12.000	11.500	26.000	103.875
29	28.600	27.275	28.220	11.000	10.800	12.000	11.500	26.000	104.275
CALENDAR WEEK AVERAGES									
Mar.									
3	28.600	27.615	28.560	11.000	10.800	12.000	11.500	26.000	101.850
10	28.600	27.330	28.275	11.000	10.800	12.000	11.500	26.000	102.800
17	28.600	27.175	28.120	11.000	10.800	12.000	11.500	26.000	103.725
24	28.600	27.340	28.285	11.000	10.800	12.000	11.500	26.000	104.175
31	28.600	27.250	28.195	11.000	10.800	12.000	11.500	26.000	104.281

THE above quotations for major nonferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered U.S. basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deducted.

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

(e) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West and West effective Apr. 1, 1960, commanded a premium of 1.50c per pound over the current market for Prime Western; Special High Grade 1.75c effective Apr. 1, 1960.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U.S. lead is corroding grade).

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Mar. 1961	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	79.625d.	279.6600	250s. 11d.
2	91.375	79.625d.	279.5980	250s. 11d.
3	91.375	79.625d.	279.5800	251s. 0d.
6	91.375	79.625d.	279.2940	251s. 2d.
7	91.375	79.625d.	279.2960	251s. 2d.
8	91.375	79.625d.	279.5240	251s. 3½d.
9	91.375	79.625d.	279.8600	250s. 10d.
10	91.375	79.625d.	279.8500	250s. 9½d.
13	91.375	79.625d.	279.9300	250s. 7½d.
14	91.375	79.625d.	279.8480	250s. 7d.
15	91.375	79.625d.	279.9420	250s. 6½d.
16	91.375	79.625d.	279.9040	250s. 7½d.
17	91.375	79.625d.	279.9000	250s. 7d.
20	91.375	79.625d.	279.8880	250s. 7d.
21	91.375	79.625d.	279.8000	250s. 7d.
22	91.375	79.625d.	279.8075	250s. 7½d.
23	91.375	79.625d.	279.8000	250s. 7d.
24	91.375	79.625d.	279.7575	250s. 8d.
27	91.375	79.625d.	279.8360	250s. 9d.
28	91.375	79.625d.	279.9260	250s. 9d.
29	91.375	79.625d.	279.8500	250s. 10d.
30	91.375	79.625d.	279.7080	250s. 10½d.
31	91.375	Holiday	279.7180	Holiday
AVERAGES FOR MONTH				
Mar.	91.375	79.625d.	279.751	—
AVERAGES FOR WEEK				
Mar.				
1	91.375	—	279.610	—
8	91.375	—	279.458	—
15	91.375	—	279.886	—
22	91.375	—	279.860	—
29	91.375	—	279.834	—

Calendar Week Averages: New York Silver: Mar. 3, 91.375; Mar. 10, 91.375; Mar. 17, 91.375; Mar. 24, 91.375; Mar. 31, 91.375.

MARKETS *(Continued)*

London Metal Exchange Quotations

Mar. 1961	Copper Cash Bid	Copper Cash Asked	Copper 3 Mon. Bid	Copper 3 Mon. Asked	Lead Current Month Bid	Lead Current Month Asked	Lead 3 Mon. Bid	Lead 3 Mon. Asked	Zinc Current Month Bid	Zinc Current Month Asked	Zinc 3 Mon. Bid	Zinc 3 Mon. Asked	Tin Cash Bid	Tin Cash Asked	Tin 3 Mon. Bid	Tin 3 Mon. Asked
1	226	226¼	226¼	226½	63¾	63⅞	64¾	64⅞	83¾	84	82¾	83	802	802½	803	803½
2	225½	226	226¼	226½	63½	63¾	64¾	64⅞	83⅜	83½	82¼	82⅝	800	801	803	803½
3	226¼	226½	227¼	227½	64½	64⅝	65¼	65½	84	84½	82⅝	82¾	803	803½	805	805½
6	225¼	225½	227	227¼	64⅝	65	65⅜	65⅝	84	84¼	82⅝	83	803½	804	806½	807
7	226	226¼	227½	227⅝	65¼	65⅜	66¼	66⅜	85⅜	85¼	83¾	83⅞	804	804½	807	807½
8	226¼	226½	227¼	227½	65⅞	66	66⅞	67	85	85¼	83⅝	83¾	806½	807	810	811
9	224¾	225	226¼	226½	65¼	65⅝	66⅝	66¾	84½	84¾	83⅜	83½	806½	807	809	809½
10	224	224¼	225¾	226	65½	65⅝	66⅝	66¾	85⅛	85¼	83¾	83⅞	807	807½	810	810½
13	223½	223¾	225	225½	65⅜	65⅞	67	67⅛	86¼	86½	84⅜	84½	811	812	813	814
14	223¼	223¾	224¾	225	66⅜	66½	67⅝	67¾	86½	86⅝	84⅝	84¾	819½	820	820	821
15	223½	224	225	225¼	66⅝	66⅞	67⅞	68	86½	87	84⅝	84¾	820	821	822	823
16	224	224¼	225½	225¾	66⅞	67	68	68⅛	86¼	86⅜	84⅜	84½	815	815½	817	818
17	225¼	225½	226¾	227	67¼	67⅜	68½	68⅝	85⅝	85¾	84¼	84⅝	817	817½	818½	819
20	227½	227¾	228¾	229	67⅜	67¼	68⅝	68½	84⅝	84¾	83½	83⅝	821	821½	823	823½
21	227¼	227½	228¼	228½	67	67¼	68⅝	68½	83⅞	84	83	83¼	820½	821½	822½	823
22	224¾	225	226¼	226½	66½	66¾	67⅞	68	83⅝	83½	83⅛	83¼	819½	820	821½	822
23	226	226¼	227½	227¾	67⅛	67¼	68⅜	68½	84½	84¾	83¾	84	823½	824	826	826½
24	226¾	227	228¼	228½	67⅝	67½	68½	68⅝	84⅝	84⅝	83¾	83⅞	825	825½	827	827½
27	225	225¼	226¾	227	66½	66¾	67¾	68	82½	82¾	82⅝	82½	821½	822	825	825½
28	223½	223¾	225¼	225½	64⅝	65	66¼	66⅜	82¼	82⅝	82⅛	82¼	820	820½	824½	825
29	224	224½	226¼	226½	65⅝	65½	66¾	66⅞	83½	83⅝	83⅛	83¼	823	824	827	827½
30	224½	224¾	226½	226¾	65⅝	65¾	66¾	66⅞	83⅝	83¾	83⅜	83½	824	825	827½	828
Av'g's	£225.278		£226.688		£65.940		£67.108		£84.577		£83.497		£814.545		£817.034	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.0%, zinc 98% and tin min. 99.7%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty extra.

MISCELLANEOUS METALS

Mar. 31, 1961

Aluminum ingot, 99.9% lb		28c
Antimony, spot, lb. less than carload, in cases, eff. Apr. 3		36.250c
In bulk, carload lots, f.o.b. Laredo		32.5c
Imported, 10 ton min. (p), 99% Duty not paid	28c —	28.25c
Bismuth, ton lots, lb		$2.25
Cadmium, ton lots delivered, lb., eff. Apr. 1		$1.60
small lots		$1.70
Calcium, lb, ton lots, 98% cast		$2.05
Chromium, 99.8% grade, lb, contract delivered	$1.15 —	$1.19
Cobalt, 97 to 99%, per lb effective 3-1-60		$1.50
Germanium, per gram, 10,000 gram lots	(d)28.15c—(c)(d)	29.95c
Indium, troy oz	$1.35 —	$2.25
Lithium, lb, 98%	$9.00 —	$11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr 16		35.25c
Palladium, troy oz	$24 —	$26
Platinum, troy oz	$80 —	$85
Quicksilver, flask of 76 lb, 25 flasks or more	$206 —	$209
Selenium, 99 plus %, lb—(Feb. 19, 1958)	$6.50 —	$7.50
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb., lump		$360
Tellurium, lb		$4.00
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b)	$1.50 —	$1.60

(a) Effective Dec. 6, 1956; including U. S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu; spot	$32 —	$33
term contracts	$34 —	$34.50
Chrome ore per long ton, f.o.b. cars Atlantic ports, dry:		
44% Cr_2O_3 no ratio	(a)$19.75 —	$20.50
48% Cr_2O_3 3 to 1 ratio	$35¾ —	$38
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.85(e)
Mesabi bessemer		$11.60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$125.16
Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra.	(n)87c—90c.	Long-term contract nominal.
Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.18 —	$1.25
Tungsten ore, per stu of WO_3:		
Foreign 65%, c.i.f. U. S. ports, duty extra	$15.25 —	$15.75
U. S. scheelite, f.o.b. mill	$22 —	$24
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton		$68

(a) Nominal. (b) c.i.f. U. S. ports. (e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl, carload lots N. Y. docks		4c
Cobalt oxide, 72½% to 73½%, per lb, effective Mar. 1, 1960	$1.15 —	$1.18
Copper sulphate, 100 lb. effective 10-12-60		$12.00
Germanium dioxide, gm		16¾c
Molybdic trioxide, technical, per lb of Mo	$1.46 —	$1.47
Imported, including 37c duty	$1.75 —	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4-9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		11c
Ferromolybdenum, 58 to 64% Mo. lb of Mo contained	$1.50 —	$1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.25
Ferrovanadium, per lb of V delivered	$3.20 —	$3.40
Silicomanganese, max., 1½% C, lb contracts		11.6c
Spiegeleisen, per lt. 19-21% grade effective Jan. 22, 1960	$100.00 —	$102.50

NONMETALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,400–$1,725	Paper stock	$120–$142
Crude No. 2	$750–$1,155	Waste	$75– $86
Spinning Fibers	$370– $600	Shorts	$40– $75
Shingle fibers	$180– $220		
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1	$1,522	Spinning fibers	$470–$787
Asbestos, Vermont, f.o.b. Morrisville:		Shingle fibers	$142–$325
Spinning fibers	$353– $408	Waste, stucco or plaster	$86
Shingle stock	$181– $218		
Paper stock	$120– $142	Refuse or shorts	$41– $75

Barytes, f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94%, $BaSO_4$, per st	$16 —	$18
Crude oil well grade, min. 4.3 sp gr, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 —	$18
Bauxite, st, f.o.b. point of shipment:		
Imported metallurgical, per lt, f.o.b. Br. Guiana, 60% Al_2O_3, 6% SiO_2, 1.25% Fe, 1-1-60		$7.25
Feldspar, bulk ton; f.o.b. plants:		
Potash or soda feldspar, 200 mesh, ceramic grade	$17 —	$20.50
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 —	$41
60% effective CaF_2	$33 —	$36
Acid 97% concentrate, bulk, ton		$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 —	$14.00
Magnesite, per ton dead-burned, bulk, f.o b. Washington		$46

Mica—Domestic, f.o.b. mines, Punch 7c-12c per lb according to size and quality. Sheet clear 1½x2 in. 70c-$1.10; 2x2 in $1.10 to $1.60; 2x3 in, $1.60-$2.10; 3x3 in, $1.80-$2.30; 3x4 in, $2.00-$2.60; 3x5 in, $2.60-$3.00; 4x6 in, $2.75-$4.00; 6x8 in, $4.00-$8.00. Wet' ground, very fine, $140-$155 per ton, Bulk sales, dry ground; $30-$55 per ton. Scrap $20-$30.

Ocher Georgia, ton in sacks	$26.50 —	$32.00
Sulphur, Mexican, for use in Mexico, metric ton, f.o.b. mines, depending on location	$21 —	$23
For export f.o.b. vessel, depending on grade	$22.50 —	$23.50

Actual prices received by U. S. producers approximate the Mexican export prices.

Talc, f.o.b. works, ton:		
New York, purified	$18.00 —	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50 (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30 —	$5.50

California iron mine gets tractor work done fast with just one LeTourneau-Westinghouse Tournatractor. The LW tractor not only replaced one full-time crawler; it also does the part-time plant and pit-maintenance work formerly assigned to a *second* track-type machine. The change to the faster, more maneuverable, LW tractor enables the mine to keep haul units moving with less delays.

Missouri silica mine keeps ahead of tight production schedule with help of Tournatractor. Working in extremely abrasive sand, and across uneven pit floor, LW tractor takes on a full circuit of towing and pushing duties, haul-road building and maintenance, stripping, shovel and general clean-up dozing. Plant manager says, "The abrasion, rough-going, and back-and-forth travel is too rough for crawlers."

Virginia quarry once used 2 crawler tractors for clean-up. But because of their slow speed and excessive maintenance, owners looked for a more economical type of tractor. Today, pit manager says, "We bought 1 Tournatractor to replace 2 crawlers. It's very successful . . . we like its speed and versatility." Here, LW tractor push-loads D Tournapull® in heavy clay overburden.

These 5 Tournatractor® owners report lower cost, higher production

Get the facts on how one go-anywhere Tournatractor can replace two or more of your track-type tractors on pit maintenance. We'll be happy to demonstrate.

Arizona copper mine keeps operations running efficiently with help of 3 Tournatractors. The 218-hp rubber-tired tractors work 16 hr a day to clean around shovels . . . to maintain waste dumps and haul roads . . . to tow stalled trucks and other equipment. Says mine superintendent, "Our Tournatractors complete a variety of scattered jobs over a wide area fast!"

Illinois quarry maintains production of more than 3,000,000 tons yearly with help of 2 LeTourneau-Westinghouse Tournatractors. One does all the clean-up around 3 shovels spaced about a mile apart. The other maintains 12 stockpiles of crushed stone located within the mile-square pit and neighboring plant areas.

NOW...a choice of Tournatractors
In addition to the standard electric-control LW tractor, LeTourneau-Westinghouse now offers you a Tournatractor with hydraulic blade control. This unit is equipped with the GM V-Power diesel engine (6V-71) producing 218 hp. Top speeds: 18.5 mph forward, 6.2 mph reverse. See us for details. CT-2343-MQ-1

See the new LW Tournatractor at the Coal Show in Cleveland, May 15-18th, Booth No. 1723

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Haulpak® is delivering at LOWEST NET COST

Acceptance of the LW Haulpak, first all-new truck in a quarter-century, has been fast. Perhaps the best explanation for this wide-spread acceptance comes from *owners** themselves. One puts it this way: "We needed trucks large and rugged enough to handle big loads, yet fast and maneuverable enough to do it *economically*. And we believe that with Haulpak, *we have it!*" Another says: "Haulpaks have cut our truck maintenance costs *almost in half*."

There's a tip for *you* in this owner's comment: "After a trip by three officials of our company to see these units in action, *we chose Haulpak*." Let us arrange a demonstration for you. See first-hand how *you* can get extra tons per hour, at lowest net cost per ton-mile, with LW Haulpaks. 5 end-dump sizes: 22 to 60 tons, up to 550 hp.

▲ Owned 3 . . . bought 3 more!

Enthusiasm for Haulpak trucks runs high at this large U.S. cement plant (above). The firm put 3 LeTourneau-Westinghouse 32-ton Haulpaks to work on 7,100-ft hauls. Adverse grades averaged 1.3% . . . max. was 400 ft of 5% adverse grade. Haulpaks completed cycles in an average of 8.58 minutes. Production per 50-minute hour averaged 179 tons per machine. This steady output, coupled with low-maintenance performance, led to a repeat order for 3 more 32-ton Haulpaks . . . making a total of 6 in their fleet to date.

*Names on request

HP-2387-MQJ-2

LW® LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company Where quality is a habit

In NEBRASKA

Hauling 32-ton loads of overburden to dump area, LeTourneau-Westinghouse Haulpaks cruise along well-maintained roads at speeds to 38.8 mph. Safe? You bet! There's a total of 5,148 sq in. braking surface on 32-ton Haulpak . . . *four times* the braking area of most comparable-capacity trucks.

In INDIANA

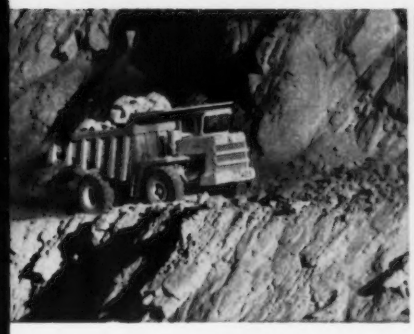
27-ton Haulpak highballs over typical quarry road. Hydrair® suspension cushions travel shocks . . . keeps load riding level, reduces spillage during high-speed haul. Center of gravity is *low*, because about 6 tons of material are carried *below* normal truck floorline in Haulpak's deep V-body.

In UTAH

Here's the big 550-hp, 60-ton Haulpak in action. This latest addition to LW line, carries almost *twice* its own weight in payload capacity! Weighs approx 66,000 lbs, carries 120,000-lb payload. Reason: high-tensile-strength steels, nearly 3 times stronger, ⅓ lighter than in ordinary trucks.

In CALIFORNIA

Heaped with rock, 32-ton Haulpak shows plenty of power and pep as it climbs grade. Pit-to-plant hauls are long . . . grades, steep and winding. Talking about acceleration and power, another LW owner reports: "Our Haulpaks come out of the pit in a higher gear, and at a faster rate of speed, than any unit we are familiar with."



In NEW MEXICO

Over-the-edge dumping minimizes clean-up on this waste bank. Notice how edge of bowl swings low, well back of rear wheels, as the body starts to raise. Dump action is fast, too! Twin hydraulic rams lift the body to full dump-angle in approx 16 seconds. LeTourneau-Westinghouse Haulpak shown below is 27-ton size.

In PENNSYLVANIA

Stripping contractor owns 4 of these LW 32-ton Haulpaks. Comparing them with conventional 22-ton trucks, contractor says: "Haulpak's short turn-around, plus high hauling speeds, mean that each of these 32-ton trucks gains one complete round trip in every seven on hauls of average length. Ours vary from 800 to 2500 feet."

PER TON-MILE for owners everywhere

In ILLINOIS

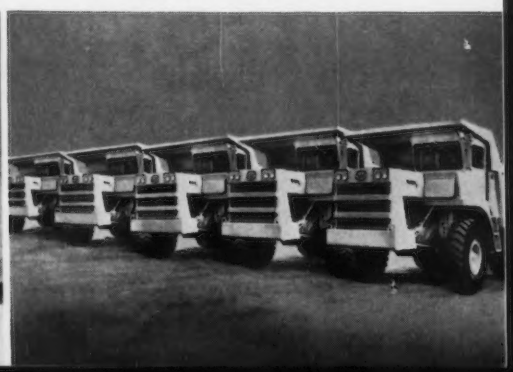
At this strip-mine, special *bottom-dump* Haulpaks carry 90 tons of coal per trip. Performance-proven since 1957, this giant LW hauler has: springless Hydrair suspension on all wheels, Hydrair trailer-hitch, Power-Transfer differential, and many other "firsts" in big trucks.

In NEVADA

This 60-ton Haulpak works around the clock, 7 days a week, on a mile-long haul. Average adverse grade: 7%. It's a grueling assignment, but LW Haulpak has the matched power, speed, and structural strength it takes to beat tough work schedules. Haulpak's production: 1668 tons per 7-hour shift!

Destination: LIBERIA

With 5 LW Haulpaks already at work, 7 more are on their way to a Liberian mine. Here's part of the latest 27-ton Haulpak fleet being readied for overseas shipment. In addition, the African mining firm has 2 LW 440 graders, and 9 C Tournapulls® building a railroad service line.



NEW SUPER-TOUGH ORE HAULER USES

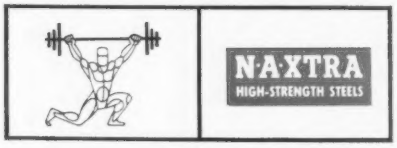
N-A-XTRA

HIGH-STRENGTH STEEL TO CUT DEAD WEIGHT AND STRETCH PAYLOAD CAPACITY

This Lectra Haul M-55, made by Unit Rig and Equipment Co. of Tulsa, is now working in the open pit iron mines in Minnesota's Mesabi range. In bone-freezing —40° weather, it can stand up to the shuddering shock of 55 tons of drop-loaded iron ore, climb a 6% grade at 8.6 mph then dump those 55 tons in a crashing, grinding 18 seconds. The quarry body that takes this loading impact and dumping abrasion in sub-zero temperatures is made of N-A-XTRA high-strength steel, with X-A-R Abrasion Resistant Steel for extra hardness and toughness in wear areas. N-A-XTRA also forms the structural members of the complete unit.

Why N-A-XTRA? Because, pound for pound, it's nearly three times stronger than ordinary steel. That means it's strong enough to absorb severe punishment without constant maintenance, and light enough to handle the highest possible payload. In fact, the Lectra Haul payload is almost as much as the net vehicle weight itself.

N-A-XTRA and X-A-R are doing the job where only the strongest steels will do. Easily formed and welded, they are making products stronger, lighter, longer lasting. N-A-XTRA fully quenched and tempered steel is available in four levels of minimum yield strengths, from 80,000 to 110,000 psi. X-A-R steels are supplied in hardnesses from 360 to 400 BHN (or, by agreement, in a range between 265 and 500 Brinell). For full technical information, write Great Lakes Steel Corporation, Product Development, Dept. EMJ-1, P.O. Box 7310, Detroit 2, Michigan.



A PRODUCT OF

GREAT LAKES STEEL

Detroit 29, Michigan

N-A-XTRA AND X-A-R STEELS ARE AVAILABLE AT THESE STEEL SERVICE CENTERS

Benedict-Miller, Inc. Lyndhurst, New Jersey	Joseph Demsey Co. Cleveland, Ohio	Ducommun Metals & Supply Co. Los Angeles, California
Interstate Steel Co. Evanston, Illinois	Lockhart Iron & Steel Co. Pittsburgh, Pennsylvania	Marsh Steel & Aluminum Co. Kansas City, Missouri
O'Neal Steel, Inc. Birmingham, Alabama	Salt Lake Hardware Co. Salt Lake City, Utah	A. C. Leslie & Company, Ltd. Montreal, Canada

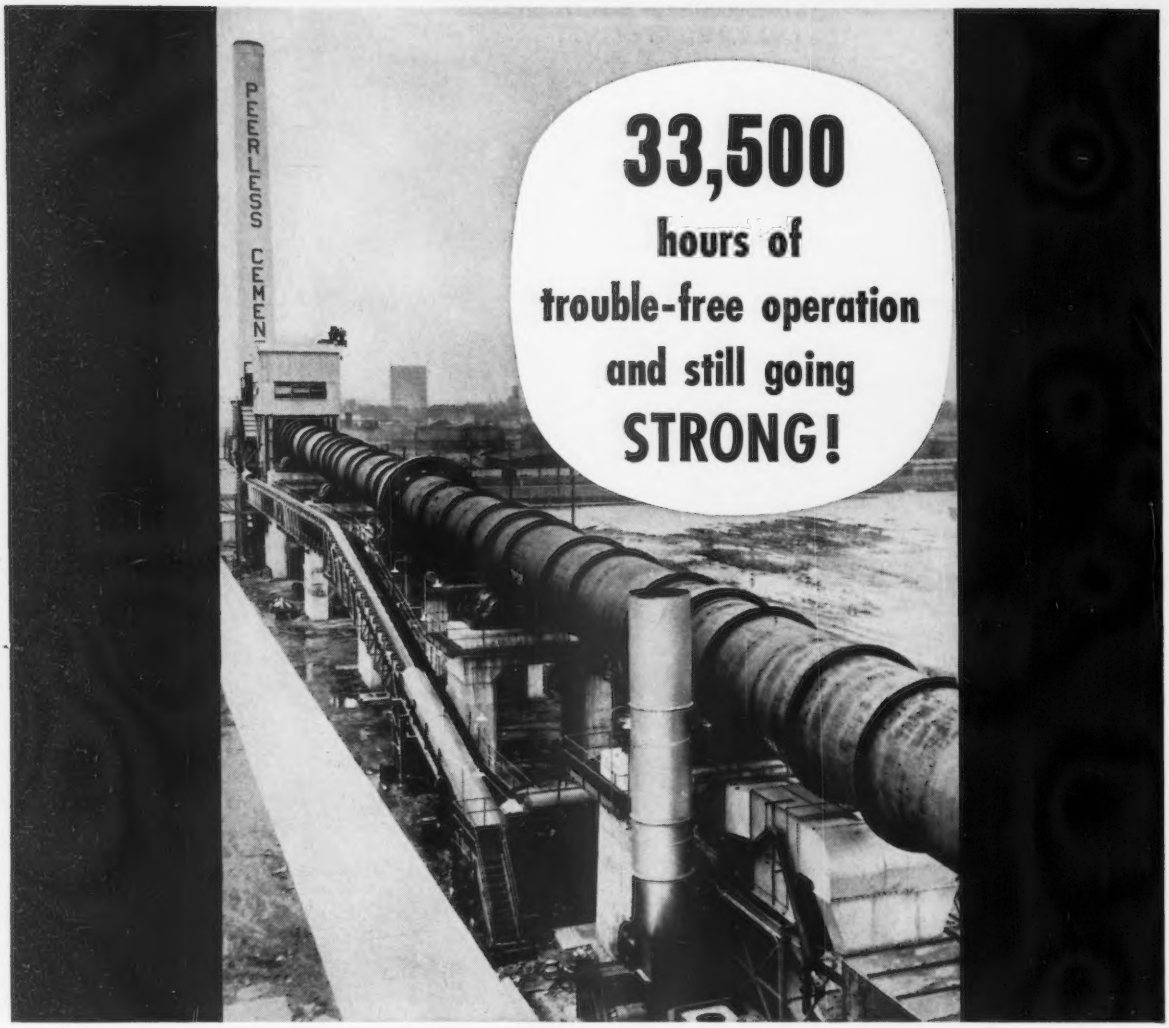
Lectra Haul M-55; made by
Unit Rig and Equipment Co., Tulsa, Okla.
224,000 lbs. GVW
110,000 lbs. capacity
700-hp. diesel engine
4 wheel-mounted electric traction motors

Steel

Look for the STEELMARK on the products you buy; place it on the products you sell.

Design note: Bottom, sides and front of the Lectra Haul quarry body were fabricated of N-A-XTRA 100 (100,000 psi minimum yield strength) from plates ½" thick and reinforced with cold-formed channels of ⅜" thick N-A-XTRA 100. Wear areas of bottom, side and front slopes were made of X-A-R Abrasion Resistant Steel from plates ⅝" thick, 388 Brinell hardness. Fabrication followed standard shearing, gas cutting and welding procedures.

Great Lakes Steel is a Division of **NATIONAL STEEL CORPORATION**



Typical performance of a **TRAYLOR** rotary kiln

Installed in 1956 at the Peerless Cement Company's Brennan Avenue plant, Detroit, Michigan, this 11′6″ x 425′ kiln has averaged 23 hours of operation a day without costly downtime. Traylor engineers, intimately acquainted with the problems and needs of the cement industry, painstakingly research and design each kiln to do its specific job. That's why Traylor kilns are noted the world over for minimum downtime and maximum years of profitable operation.

See Chemical Engineering Catalog for further details and specifications

TRAYLOR ENGINEERING & MANUFACTURING
DIVISION OF FULLER COMPANY
1553 MILL STREET, ALLENTOWN, PA.
Sales Offices: New York—Chicago—San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

TKA-10

"4-in-1 gives the advantages of several machines in one"

—report mine and quarry owners

"Our 4-in-1 is much more than a loader or a dozer," reports Milton Reeves, for B. S. & K. Mining and Milling Co., Silver Bell, Arizona. "Its lifting and heavy material handling ability is tremendous, and indispensable in our operation." The 1½ cu. yd. TD-9 Four-in-One owned by this zinc and copper mining firm is shown digging compacted, rocky material for haul road repair. This model exerts 19,000 lbs. of power-shovel-like pry-over-shoe break-out force. The rig is also used to load ore on trucks, do clean-up and other key jobs.

"I get the advantages of several different pieces of equipment in one from my 4-in-1," states Paul H. Morris, owner, Morris Enterprises, Owensboro, Kentucky. "My TD-15 rig has way exceeded my original expectations!" His 4-in-1 is shown maintaining a haul road at a Morris strip mine. The 4-in-1 also cleans coal seam, loads washed coal when needed, builds haul roads, and is available to help other equipment remove overburden.

"Just like you say!" reports Superintendent Ralph Lewis for Dulin Bauxite Company, Murfreesboro, Arkansas, "we can use the International Drott 4-in-1 as a clamshell, shovel, dozer, and other machines. Our TD-15 Four-in-One has helped tremendously in stepping up our production." Their 2¼-cu. yd. 4-in-1 proved it can outshovel a boom-type shovel loading gypsum, the firm's present product. Note how controlled clamshell bottom dumping allows easing material into truck.

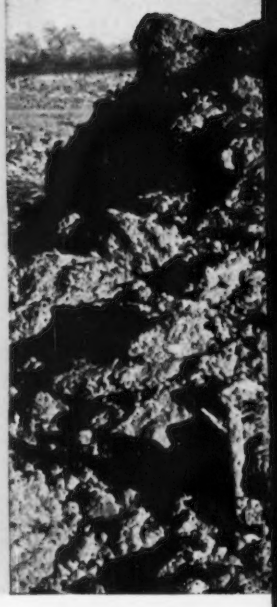
Why limit your income. Why restrict the variety and volume of work you can handle, with an old-style, "single-action" rig? See what it means to command "equipment spread" utility in one machine—and get the 4-in-1's multiple-machine earning power for one moderate investment. See your International Drott Distributor for a demonstration!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corporation, Milwaukee 15, Wisconsin

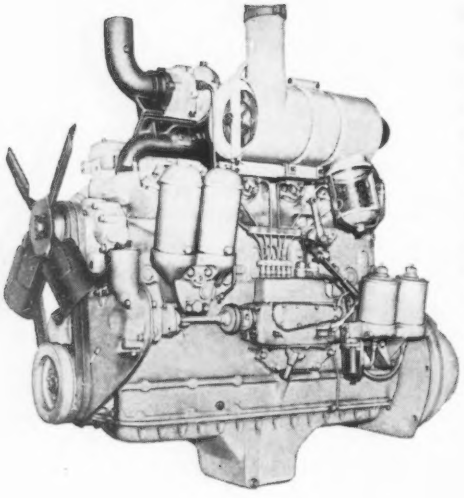
INTERNATIONAL
DROTT

NEW International® TD-

...built to "BEEF UP" your profit edge!

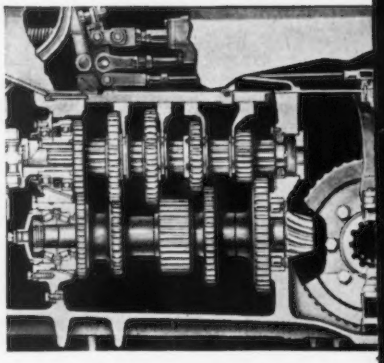


From air intake to new fixed drawbar —from day-to-day dependability through year-in, year-out durability—new strength, new performance protection, new work capacity are built into the new TD-20. Check and compare the advantages of International turbocharged Diesel power, teamed with beefed-to-match new transmission and final drive components—platformed on a far stronger-than-ever undercarriage—turned into new efficiency by International-built tracks, kept in life-prolonging alignment by exclusive International 3-point suspension. See your International Construction Equipment Distributor for a new TD-20 demonstration.



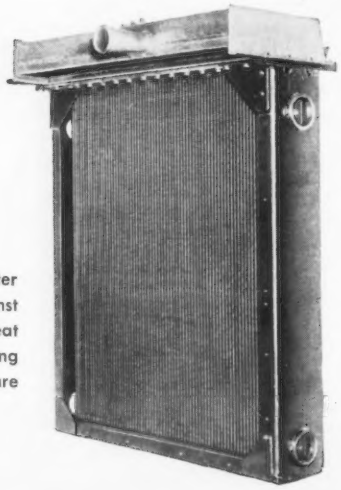
New Turbocharged Diesel Wallop

Modern turbocharging crams air into the new TD-20's smooth running 6-cylinder engine—to produce extra hp efficiently at all altitudes; and to give a 50% torque rise to lug larger overloads. Crankcase ribs are "beefed up;" cooling, air cleaning, and crankshaft capacity all are increased to team with turbocharging. Push-button TD-20 starting is by famous International gasoline-conversion system!



New transmission capacity ...New filtering system added

Heavier shafts, more rugged gears, and roller bearings of greater capacity are provided—to carry increased hp and add thousands of hours to working life of power train components. New transmission oil pump circulates and filters life-guarding lubricant. New "short-travel" levers add operating ease.



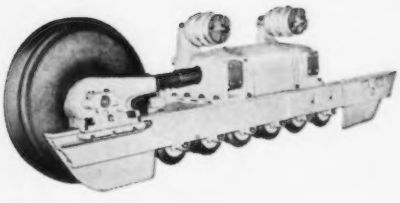
Larger radiator plus jet head increases cooling capacity

Coolant, under pressure from the new greater capacity radiator, is shot through jets against lower surface of TD-20 heads—to aid heat transfer and avoid build-up of heat-trapping deposits. Fan shroud and radiator guard are "heavied" for increased rigidity.

20

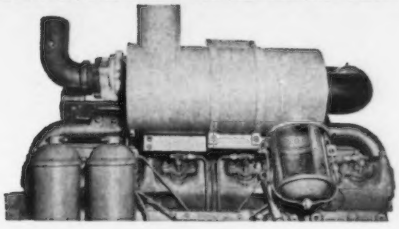
(201 SERIES)

New 140-hp International TD-20 crawler tractor. Develops 113 drawbar hp. Powered by 6-cylinder DT-691 Turbocharged Diesel engine. New capacity 6-speed, full-reverse transmission is controlled by new short-travel gear-shift and Shuttle-Bar levers.



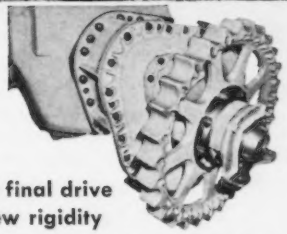
New Undercarriage Strength and Protection

New drum-type front idlers add strength... International also adds track chain guides to both sides of the TD-20's precision-welded double box-beam track frames! New track roller shields are of cast steel. New heavier strutless track links are self-cleaning and power-saving. The new hydraulic track adjuster, with built-in safety relief is "standard" on the new TD-20. And full-floating seals of increased efficiency guard Dura-Roller life!



New 99.8% efficient Dry-Type air cleaner

For positive "breathing" safety, the full air volume taken in by turbocharging is "dry-cleaned" of 99.8% of its dirt—by the TD-20 Diesel's new dry-type air cleaner. Handy, under-hood horizontal mounting—and transparent, quick-dump collector—greatly simplify servicing. Dash indicator shows "red" when cleaner element needs washing.



New final drive ...new rigidity

New TD-20 final drives have been strengthened to deliver full torque turbocharged power to the tracks. New sprocket drive doweling increases housing rigidity—helps maintain precision component alignment. Other major steps ahead in TD-20 design include: new torque-taking, life-adding bimetallic steering clutch discs; new pivot shaft inner spacer; new hardness of sprocket drive pinion shaft.

International® Construction Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois

A COMPLETE POWER PACKAGE

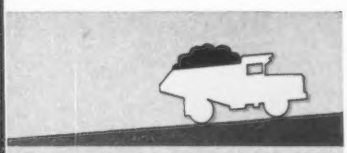
THE STEEPER THE GRADE...

the more "extra" loads a cycle-gaining Payhauler® gives you

Of all three 27-ton off-road haulers, only the International 95 Payhauler gives you the weight-shedding, strength-multiplying advantages of the rock-ribbed, corrugated body. Only the "95" is plus-powered by the 375-hp DT-817 turbocharged Diesel. And only the "95" gives you an exclusive combination of power-control, safety, and comfort features that turns haul-speed advantages into extra haul-cycles! *Prove to yourself* what comparative grade charts and work-tally sheets show! See your International Construction Equipment Distributor for a Payhauler demonstration!

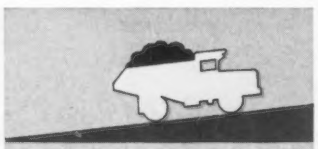
Positive Torqmatic braking gives the operator complete control of this fully-loaded "95"—builds confidence to use the highest practical haul speeds, even when hauling down the steepest grades. "One-hand" power-steering teams with finger-tip brake lever control to give course-holding, grade-matching downgrade hauling stability. Torqmatic braking, standard equipment on the power-shift "95," is a Payhauler *plus*—furnished in addition to the standard, internal-expanding wheel brakes—to help give you "*extra*" loads on tough hauls!

Grade charts prove: only the 95 Payhauler delivers



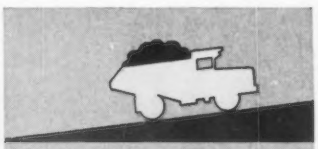
Total grade and rolling resistance, 10%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	10.2	
Competitor X	8.0	27.5%
Competitor Y	8.0	27.5%



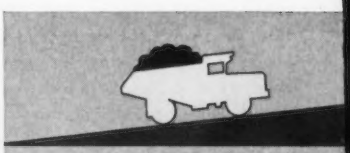
Total grade and rolling resistance, 11%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	10.1	
Competitor X	7.0	44.3%
Competitor Y	7.5	34.7%



Total grade and rolling resistance, 12%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	9.0	
Competitor X	6.3	42.9%
Competitor Y	7.0	28.6%



Total grade and rolling resistance, 13%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	7.9	
Competitor X	5.5	43.6%
Competitor Y	6.0	31.7%

Two 65 Payhauler rigs speed full 19-ton loads of dolomite from quarry to crusher—up a maximum climb-out grade of 16%. Powered by the 250-hp naturally aspirated "817" Diesel—equipped with weight-shedding corrugated steel body—the "65" consistently hauls 30% faster than competitive rigs! Price the "65"—you pay less per hp, less per struck yard and per ton of capacity than for competitive rigs!

Three 95 Payhauler trucks replace five competitive haulers in a large Chicago-area quarry. Reasons: fully-loaded "95's" haul upgrade as much as 44% faster than the competitive make—give fast, "big-target" loading—dump in only 11 seconds with exclusive power-up and power-down hoist action. And the cycle-gaining "95's" with Torqmatic power-braking, power-steering and power-shifting deliver "extra" loads on steep hauls!

International Harvester Co.
180 North Michigan Ave.
Chicago 1, Illinois

A COMPLETE POWER PACKAGE

***International®* Construction Equipment**

"extra" loads . . . over any 27-ton competitor

Total grade and rolling resistance, 14%

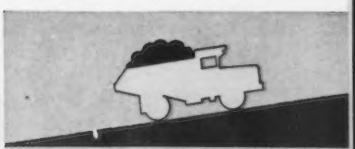
Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	7.2	
Competitor X	5.0	44. %
Competitor Y	5.5	30.9%

Total grade and rolling resistance, 15%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	6.4	
Competitor X	4.8	33.3%
Competitor Y	5.3	20.8%

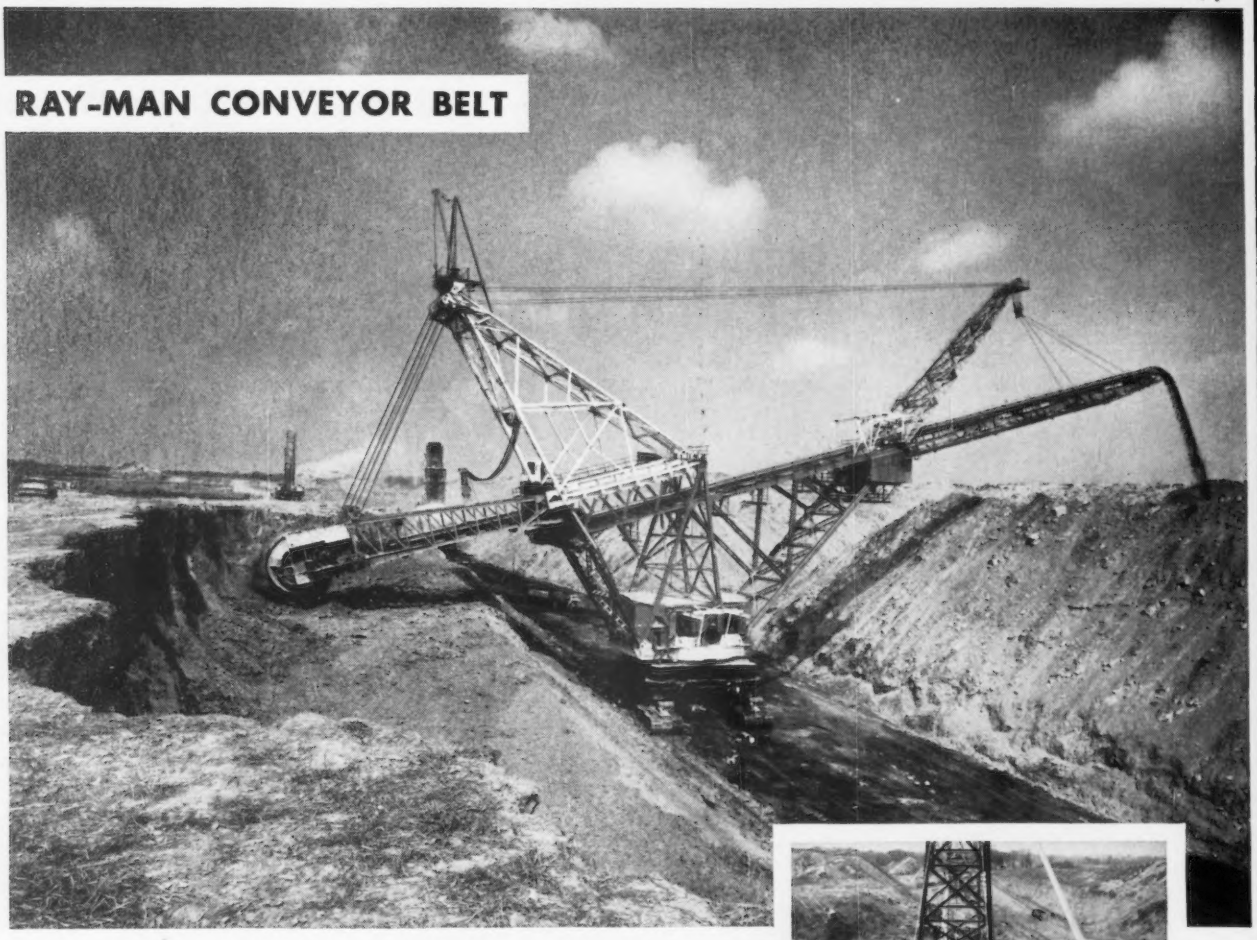
Total grade and rolling resistance, 16%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	5.8	
Competitor X	4.6	26.1%
Competitor Y	5.0	16. %



Total grade and rolling resistance, 17%

Hauler	Hauling Speed (mph)	Payhauler Advantage
95 Payhauler	5.4	
Competitor X	4.5	20. %
Competitor Y	4.9	10.2%



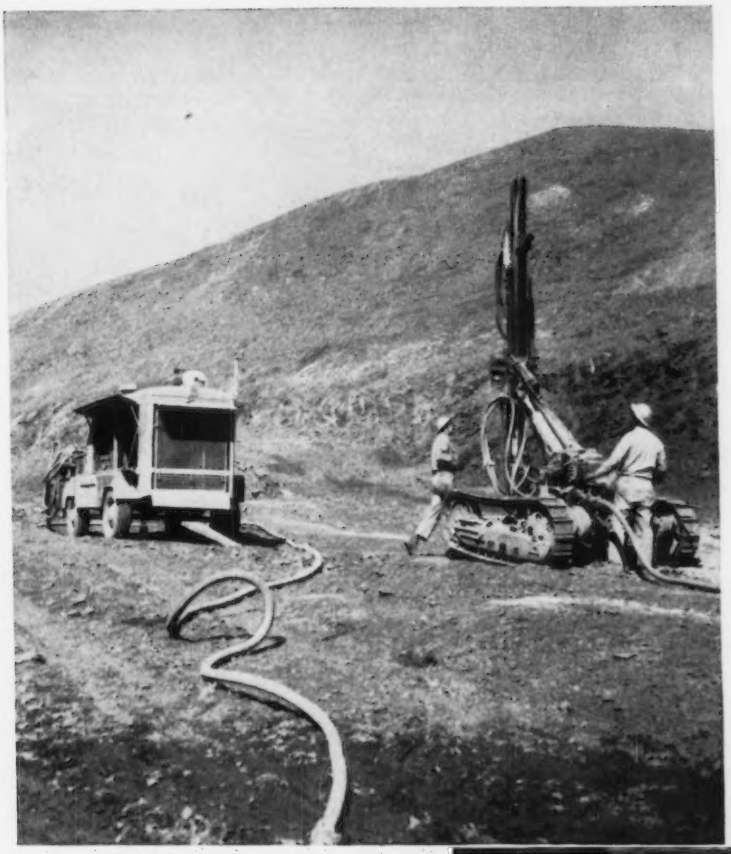
RAY-MAN CONVEYOR BELTS
On Giant Wheel Excavators
Move Overburden More Than 400 Feet ... At 5100 Tons Per Hour!

High-speed belt conveyors, with huge carrying capacities, are an integral part of this new 1,600 ton wheel excavator built for Peabody Coal Company at Bucyrus-Erie Company. High conveyor speeds—over 1,000 FPM—and high impact, put a tremendous strain on belt and belt splice. Ordinary belts can't take it. Ray-Man Conveyor Belting met the production standards of Peabody's giant earthmover—to handle *full* loads of overburden at *full* speeds *without* costly downtime for splice repairs!

Ray-Man belts on other machines of this type have hauled over 12,000,000 tons—outperforming all competitive belts. Splices last twice as long because double ply compensation relieves outer ply stress at bends. Ray-Man trains naturally, resists impact and ripping, requires no breaker ply. Exclusive XDC cover prolongs belt life. Let an R/M distributor show you how an R/M Conveyor Belt can outperform other belts on *your* conveyors. Write for Bulletin M302 and Catalog 25CB.

OVER 900 FT. OF 54" RAY-MAN CONVEYOR BELT are required for digging ladder and stacker conveyors on this huge Bucyrus-Erie Wheel Excavator. Machine will help increase output a million tons annually at Peabody Coal Company's River King Mine near Freeburg, Illinois.

RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION • PASSAIC, N. J.
ENGINEERED RUBBER PRODUCTS



HOMOFLEX HOSE Weighs Less Than Any Other Hose For Equal Pressure

It's flexible as a rope, too . . . the easiest handling air hose you can use. Homoflex has no pre-set twist . . . coils and uncoils in *any* direction *without* kinking. Strength member and tube are virtually inseparable. Uniform inside and outside diameters make it easier, *safer* to couple.

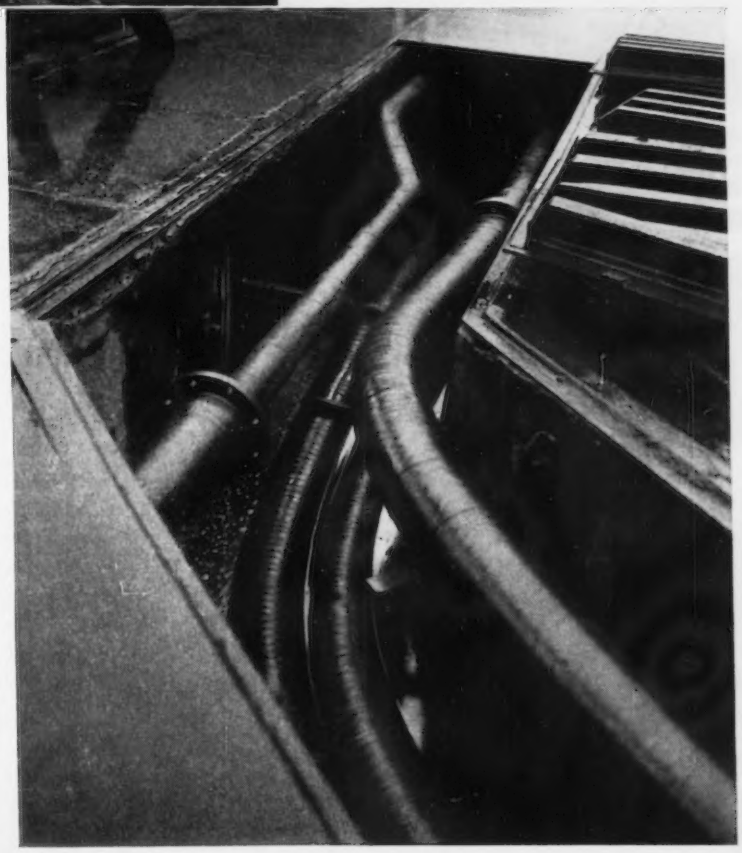
- **Super-Strong** — assures longer, trouble-free service life
- **Precision Built** — with super-strength, low-stretch cords
- **Mandrel-Made**—no pre-set twist
- **Kinkless**—coils and uncoils freely in any direction
- **Homogeneous Construction**—provides inseparable tube-to-cover bond
- **Safer, Easier To Couple**—inside and outside diameters are uniform

Ask about rugged Homoflex and other types of R/M hose for your applications. Write for Bulletins M620 and M694.

CONDOR Flexible Rubber Pipe Outlasts Iron or Steel 3 to 10 Times

It's engineered for mine service . . . for handling tailings, cinders, slag or flotation feed . . . on dewatering lines—wherever pipelines are subject to corrosion, abrasion, vibration or water hammer. Types to withstand pressures up to 250 psi feature new Hydro-Lok built-on flanges for positive seal.

R/M Rubber Expansion Joints—overcome pipe expansion stress and avoid misalignment, offer maximum resistance to shock, require no gaskets. Write for Bulletin 7152.



This Condor Rubber Pipe is still in service after 9 years. Previously steel pipe had to be replaced every year.

RM113

USS "T-1" Steel saves 50% in welding rod costs alone

"Copper mining is awfully rough on equipment so we're always interested in ways to lower operating costs," explained Mr. Edgar Kellis, Purchasing Agent for Bagdad Copper Corporation, Bagdad, Arizona. "Our truck fleet hauls over 16,000 tons of ore and waste rock daily . . . which causes tremendous abrasion and wear to the truck bed liners.

"For this reason it's important to use the toughest possible steel. But it's equally important that the steel be easily fabricated and reasonably priced because even the toughest steel will ultimately wear out. The steel we used previously created shop problems with the end result that our costs were extremely unsatisfactory," Mr. Kellis said.

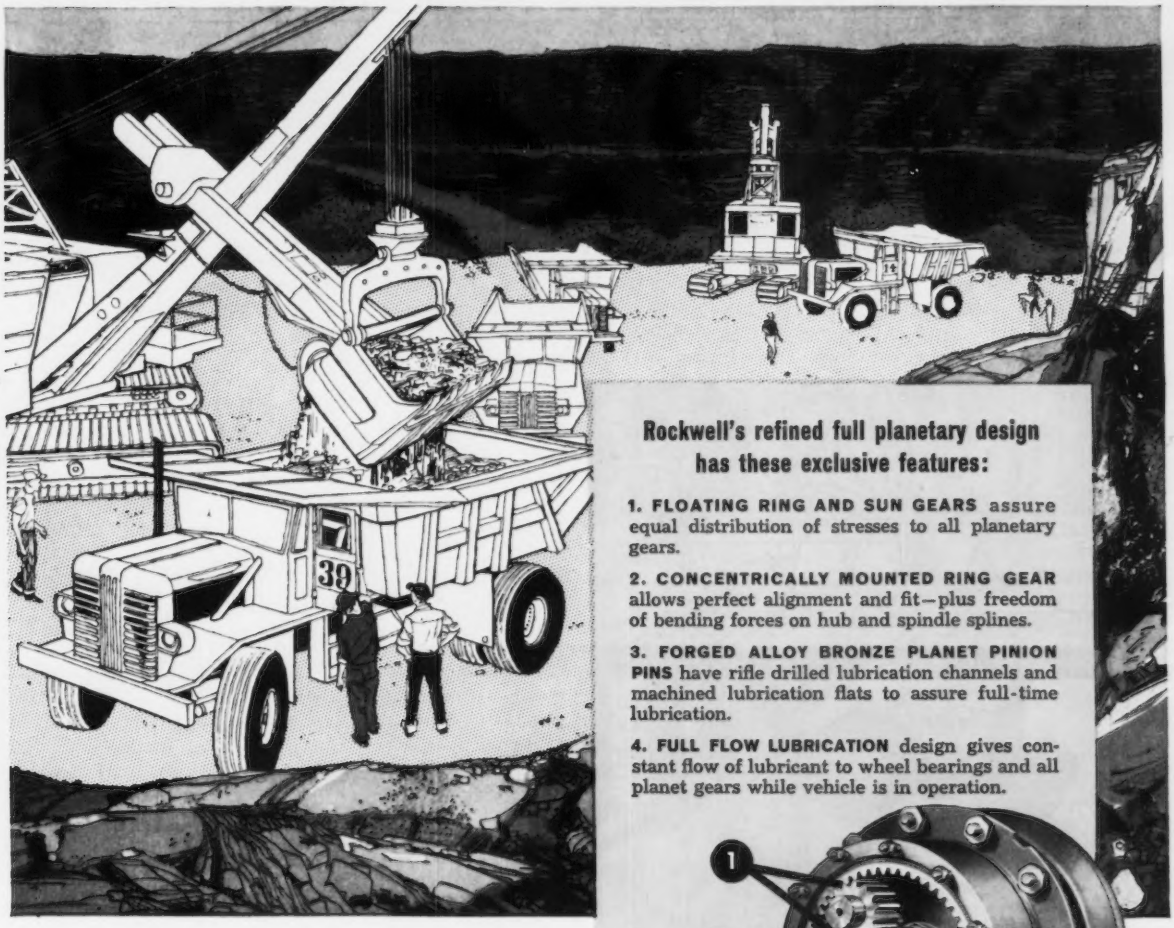
"By using USS 'T-1' Steel some of our costs have been reduced—the 'T-1' Steel wears much better—shop practices have been simplified—in fact we are saving one half in our welding rod costs alone, when welding USS 'T-1' Steel," reported Mr. Kellis. "We're also using 'T-1' Steel as wear plates in our shovels where it lasts about a year. Future plans call for 'T-1' Steel to be used in both the ball mill feeders and crusher chutes."

USS "T-1" Constructional Alloy Steel is super tough yet readily weldable. It has a minimum yield strength of 100,000 psi or a minimum hardness of 321 Brinell, if specified. Why not write for more information. United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. *USS and "T-1" are registered trademarks*

United States Steel Corporation, Pittsburgh · Columbia-Geneva Steel, San Francisco · National Tube, Pittsburgh · Tennessee Coal & Iron, Fairfield, Alabama · United States Steel Supply, Steel Service Centers · United States Steel Export Company

This mark tells you a product is made of modern, dependable Steel.

United States Steel



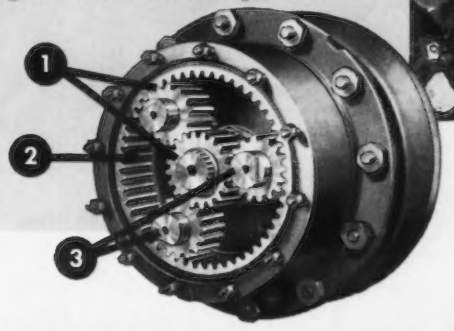
Rockwell's refined full planetary design has these exclusive features:

1. **FLOATING RING AND SUN GEARS** assure equal distribution of stresses to all planetary gears.

2. **CONCENTRICALLY MOUNTED RING GEAR** allows perfect alignment and fit—plus freedom of bending forces on hub and spindle splines.

3. **FORGED ALLOY BRONZE PLANET PINION PINS** have rifle drilled lubrication channels and machined lubrication flats to assure full-time lubrication.

4. **FULL FLOW LUBRICATION** design gives constant flow of lubricant to wheel bearings and all planet gears while vehicle is in operation.



"TIMKEN-DETROIT® PLANETARY AXLES

BEST DRIVE FOR THE HEAVYWEIGHTS!"

Here's new rugged dependability for prime movers, four-wheel tractors, heavy off-road wagons, mining and agricultural equipment, and many other heavy-duty applications. Rockwell-Standard's complete line of planetary axles are available in capacities up to 150,000 pounds. And to meet every job need, there is a planetary steering axle operationally matched to each rigid planetary in the line.

The large reductions possible with Rockwell's full planetary, double-reduction axles enable them to ideally perform most heavy-duty off-highway operations. Because the substantial planetary reduction is located in the wheel hub, axle shafts and first reduction gears carry only nominal torsional loads—give long trouble-free service. For the best heavyweight drive, specify Timken-Detroit.

Another Product of... **ROCKWELL-STANDARD CORPORATION**

Transmission and Axle Division, Detroit 32, Michigan

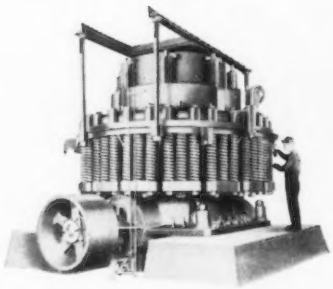
स्वर्ण

GOLD...soft, ornamental–hard master of man

In ancient times when gold was written स्वर्ण in Sanskrit, it was used for ornaments. However, it soon became a mark of status and wealth, and the search for gold changed the face of the world. New lands were discovered and populated with the word of gold discoveries.

The most common gold ores of that era were low grade, hard and abrasive igneous, sedimentary and metamorphic materials. Recovery of the gold was practical only because of the availability of slaves and conquered labor.

Mining gold ores today is a matter of high recovery at lowest possible cost. Exceptionally well-suited for this work are Symons® Cone Crushers. As a result, wherever *gold* is mined, as in all *other* important ore and mineral operations throughout the world, Symons Cone Crushers are first choice of major producers.



SYMONS® CONE CRUSHERS
. . . The machines that revolutionized crushing practice . . . **are built in a wide range of sizes, for capacities to over 1500 tons per hour. Write for descriptive literature.**

SYMONS . . . a registered Nordberg trademark known throughout the world.

NORDBERG MANUFACTURING COMPANY • Milwaukee 1, Wisconsin

NORDBERG

NORDBERG MACHINERY

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Shock-Fortified Firestones

KEEP QUARRY LOADS HUSTLING

Between multi-ton loads and rubble-strewn haulroads, it takes tough tires to keep quarry operations moving. That's why you need the extra stamina built into the Firestone Rock Grip Deep Tread.* Firestone Rubber-X, the longest-wearing rubber ever used in Firestones, is specially compounded to resist rock and shale cuts. And Firestone's Shock-Fortified nylon cord takes jarring body blows in stride. Match Firestones to all your hard-running equipment. They're backed by swift, on-the-spot service. See your Firestone Dealer or Store.

*Firestone T.M.

Always Specify Firestone Tires When Ordering New Equipment.

Firestone

FIRST IN OFF-THE-HIGHWAY TIRE NEEDS

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Tune in Eyewitness to History every Friday evening, CBS Television Network

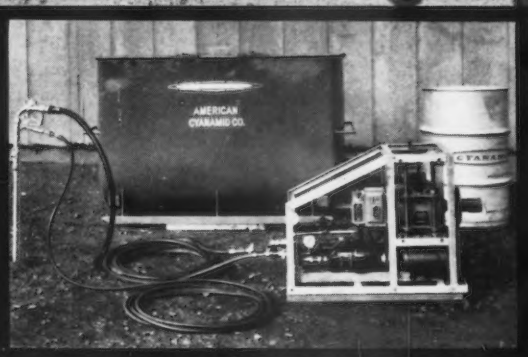
Now! there's a better, easier faster way to combat water seepage!

New CYANAMID AM:

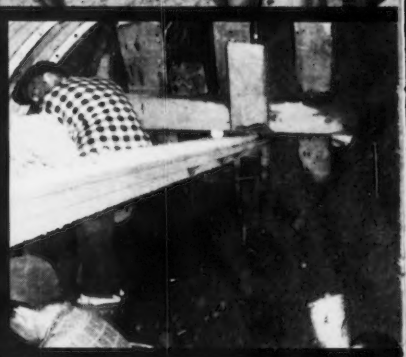
TRADE MARK

CHEMICAL GROUT

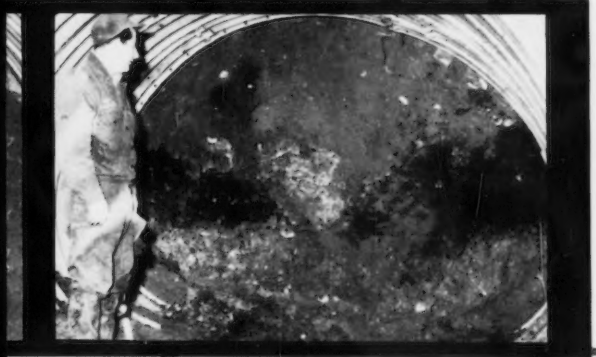
Part of the laboratory equipment used to develop grouting procedures and to study typical field problems. Effectiveness demonstrated in the laboratory has been confirmed in over 150 field applications.

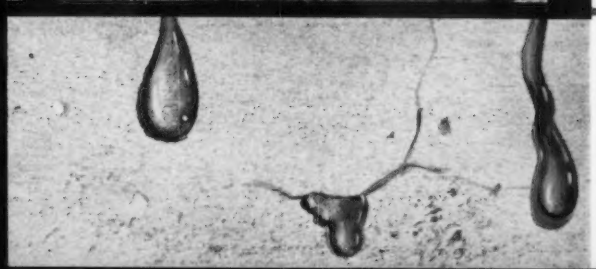


Typical equipment for injecting AM-9 includes 55 gallon catalyst tank, 250 gallon AM-9 tank, dual pumping unit and an injection point. Solutions remain separate until just before injection. Cyanamid designed and engineered pumping unit has 12 gal./min. cap.



A typical application for Cyanamid's AM-9: facilitating tunneling through soft, wet ground. Left-hand photo shows tunnel face with part of bulkhead removed. Wet running ground caused settlement of railroad tracks above tunnel. Right-hand photo shows how face was stabilized following controlled injection of AM-9.





AM-9 gives engineers a new technique to employ in controlling water seepage. An aqueous, non-viscous solution of AM-9 and catalyst injected into an underground formation solidifies into a stiff, permanent, impermeable gel that seals off water flow.

Highly effective

Because of its low viscosity, AM-9 may be placed in sands, silts and fissured rock where openings are too fine for other grouts. Viscosity of the AM-9 solution remains essentially that of water right up to the time the grout sets so it will permeate virtually any formation through which water flows. In seven years of development and field testing, no natural ground deposit has been found in which a gel cannot be made to form.

Fast and simple to use

Applications are frequently completed in 10 to 20 percent of the time required for conventional grouting. To meet varying conditions, a predetermined gel time may be closely controlled from seconds to hours by choice of catalyst concentration. This means AM-9 may be used with more precision and less waste than conventional grouts. Mixing and injection requires simple, portable equipment and limited manpower.

Wide range of applications

Properly applied, AM-9 has been remarkably effective in sealing off water in tunnels, mine shafts, coffer dams, sewer pipe joints, caissons, open excavations, oil wells, drill holes and basements, sealing underground curtain walls in and around dams and dikes and solidifying soil during tunneling, shaft sinking and excavation.

You should know about AM-9 for consideration next time you're faced with water seepage. For complete information, including the names of experienced applicators, return the coupon below.

CYANAMID

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL—*Mining Chemicals Department*
Cable Address:—Cyanamid, New York

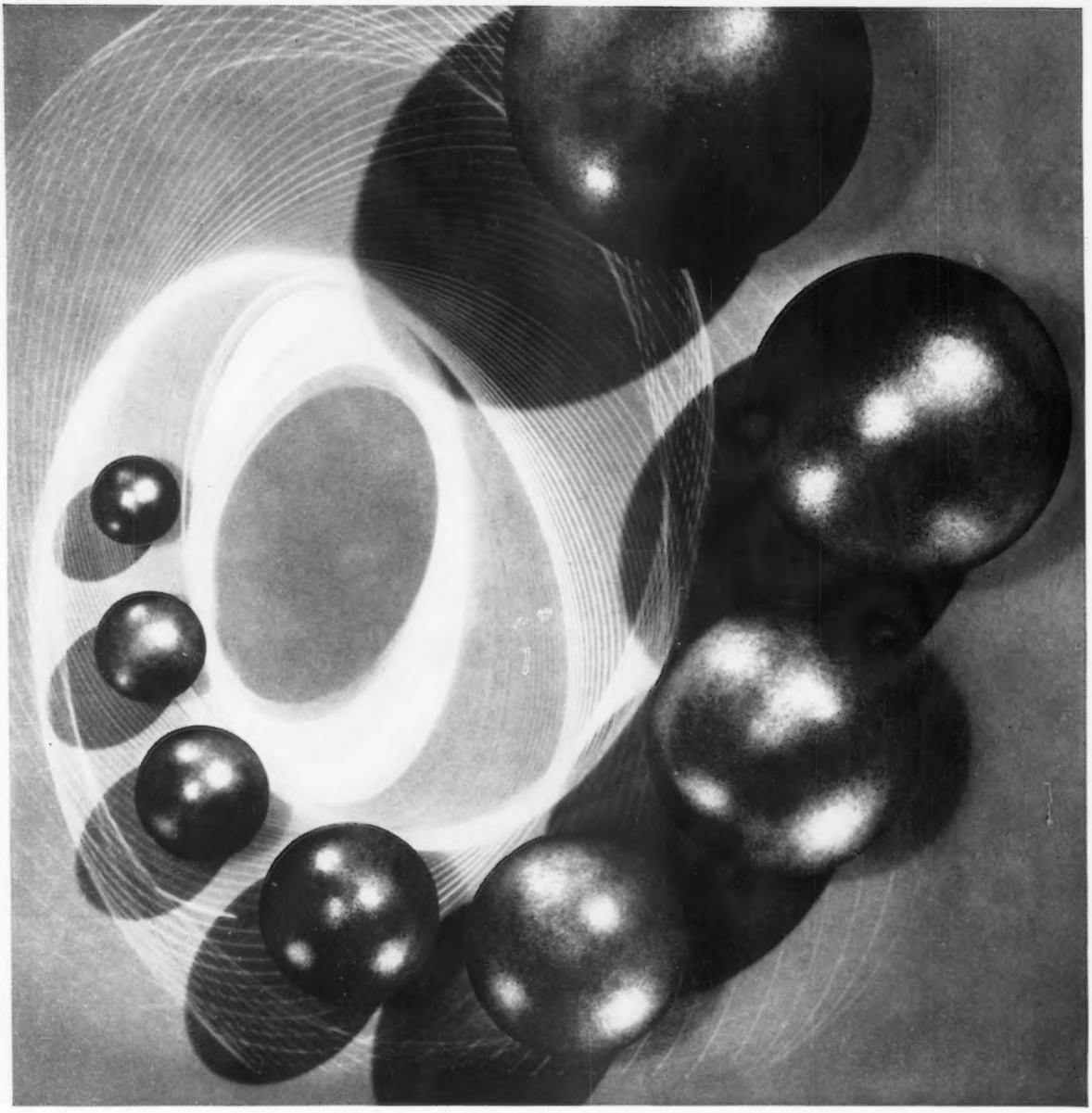
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Please send me information concerning AM-9 Chemical Grout.

Name_____

Company_____ Title_____

Address_____



CF&I controls grinding ball quality all the way

As an integrated manufacturer, CF&I has an opportunity to exercise careful quality control at every stage of grinding ball manufacture, from the mine to the finished product.

The result is forged alloy and carbon steel balls that have outstanding hardness (resistance to wear), toughness (resistance to impact splitting), uniformity of roundness and uniform density. These uniform physical properties mean better milling results for you—the user.

CF&I Grinding Balls are available in the following range of sizes: Forged Alloy Steel Balls—1½″ to 4″ in diameter; Forged Carbon Steel Balls—¾″ to 5″ in diameter.

Other quality CF&I Steel Products for The Mining Industry
Grinding Rods • Mine Rails and Accessories • Rock Bolts • Realock
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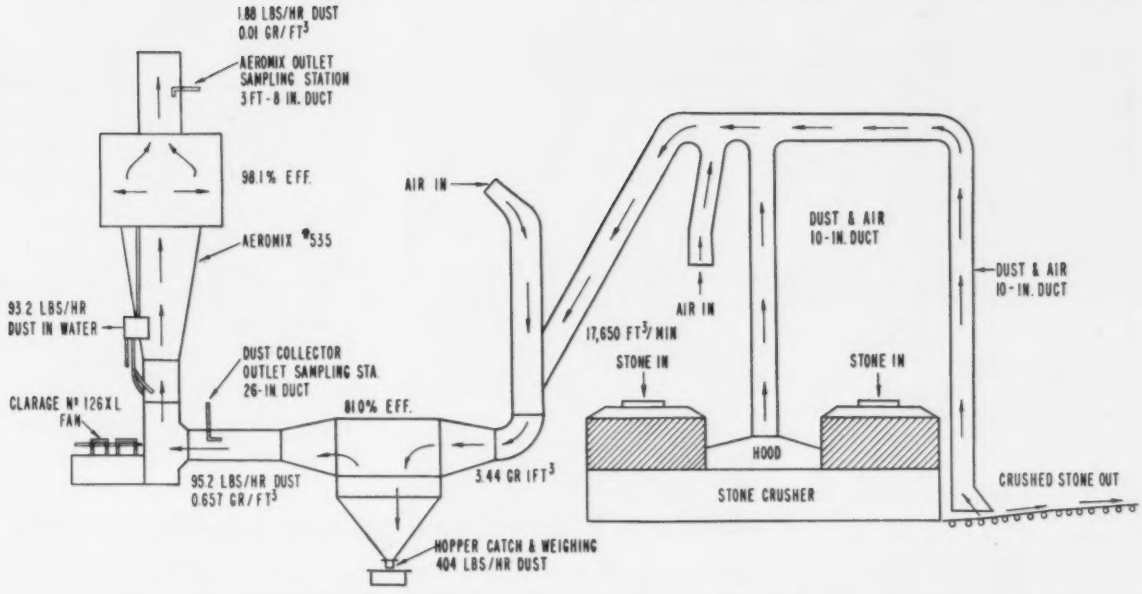


Compact, Effective Wet Scrubber Causes Minimum Pressure Drop (45)

AN EFFICIENT wet scrubber, Aeromix, after undergoing intensive testing and development for some time is now performing effectively in a wide variety of installations. According to the manufacturer, Aerotec Industries, Inc., the scrubber reduces air pollution, absorbs soluble gases, and recovers soluble or insoluble particulate matter. It does this, the company said, without consuming much liquid, without causing a great pressure drop and without taking up too much space.

The distinctive feature of the Aeromix scrubber is its dense bed of liquid in a finely divided state, created by internal recirculation in a vertical diffuser tube. Aerotec said that the liquid particle layer greatly increases the contact of the liquid with material to be collected from the gas or air over a wide operating range. The unit has no filters, pumps or nozzles.

At one installation, the Hudson Cement Co. plant, Kingston, N.Y., the Aeromix scrubber cleans dust-laden air produced by a primary crusher which reduces the

quarry rock to approximately six in. and by a secondary unit which reduces some of the rock to 1½ in.

Hudson's secondary crusher is a 36-in. gyratory unit which handles 1,000 tph. The crusher's dust-laden air and the belt discharge are drawn through hoods at a rate of 17,000 cu ft per minute and passed through a tubular collector that removes the bulk of the coarse dust, discharging it through a dust valve to the belt conveyor.

At the tubular collector outlet, a fan discharges upward in the Aeromix unit through a transition pipe which is equipped with a water trap (see flowsheet).

Aerotec said that Hudson's system was thoroughly tested after it had been operating for three weeks and it was found that: 1) total dust removal efficiency was 99.6%; 2) average mechanical collector efficiency was 82.7%; 3) average Aeromix efficiency was 97.7%; 4) average dust concentration at the inlet was 3.4 grains per cu ft; 5) average exit concentration of the Aeromix was 0.03 grains per cu ft.

Versatile Drill Rig (37)

RUGGED, heavy-duty, truck-mounted combination core drill and auger is being introduced by the Acker Drill Co.

The new rig, Acker SP, handles all types of diamond bit coring and auger boring for soil sampling, hollow stem augering, geophysical and geological exploration, etc.

SP can auger to 300 ft, core drill to 1500 ft, and can produce holes up to 24 in. in dia. It handles five-ft hollow stem or conventional auger flights, and switches to roller stock, carbide, saw tooth or diamond bit coring. Full 360° rotation permits angle or vertical holes.

Crusher Oiling System (38)

NEW OILING SYSTEM which eliminates the risk of crusher bearings running dry if under-greased, or heating when over-greased, has just been announced by Smith Engineering Works for its Telsmith jaw crushers.

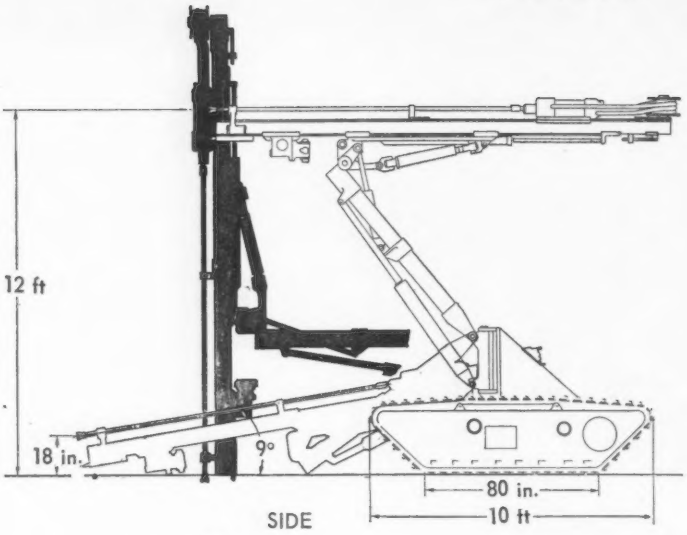
According to the company, the machine runs cooler, bearings get the protection they need, and downtime and maintenance have been greatly reduced.

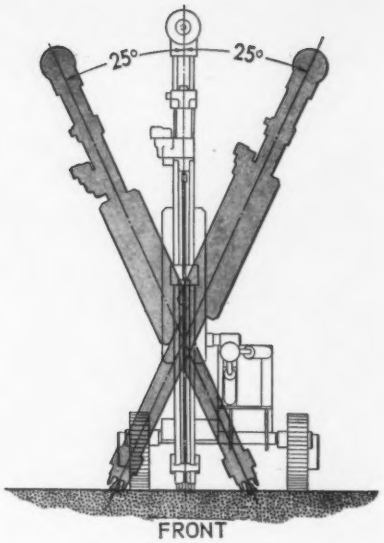
The compact self-contained oiling unit is mounted on the crusher and operated by its own tank-mounted pump and motor. Flexible hoses bring oil to the bearings and return it to the reservoir.

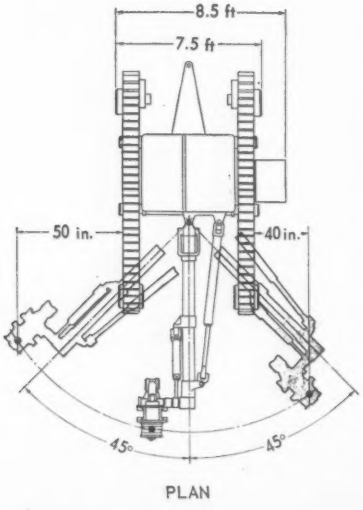
Submersible Pump (48)

COMPACT 88-LB SUBMERSIBLE PUMP capable of capacities exceeding 20,000 gph and heads to 105 ft has just been introduced by Flygt Corp. It's called the Bibo 3″ and has redesigned impellers to achieve greater capacity, lower power consumption.

Because the electric Bibo is light and compact, one man can carry or place it easily. Fewer parts are involved and this simplifies the maintenance-service schedules. Larger, more accessible junction box enables connections to be made more easily, and modern, compact casing is easy to handle.







New Drill Requires Few Manual Adjustments (57)

NEW CRAWLER-MOUNTED DRILL with remote controls and other labor-saving devices has been introduced by Joy Mfg. Co. The drill, the TDM-Bl, can be positioned over the side of the crawlers for line drilling in confined areas—it has a flexible swinging boom which permits hydraulic positioning of the feed and drill to put down holes in a lateral arc 45° from center.

Drilling controls are mounted on an arm which swings with the boom, yet may be adjusted to vary the distance between the drill and the operator. Full range power positioning provides conversion from vertical to horizontal drilling without manual adjustment. According to Joy, another new feature is an automatic hose reel which is mounted on the feed and geared into the feed mechanism to keep the hoses which lead to the drill aligned and out of the way.

TDM-Bl carries the Joy 450-DR dual rotation drill as standard equipment. The 450-R has an independent, integral air motor to provide hammerless rotation for coupling and uncoupling drill steel, and to assist conventional rifle-bar rotation in tight ground—it increases drilling speed and helps eliminate stuck steels.

The new unit's chassis is of extra rugged construction with 23 hp for tramming. Hydraulic power handles all positioning of the drill and feed. The feed handles 12 ft steel changes.

TDM-Bl can drill either vertically or horizontally. Joy said it builds a variation of the machine for underground work, TDM-B2. It drills horizontally and has seat and controls behind boom.

Tiny Electric Ore Truck (9)

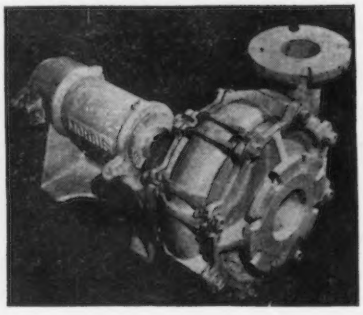
GETMAN BROTHERS' new battery-powered underground truck, the Model BE-18, has 2/3-yd capacity, has three forward and three reverse speeds, and can be loaded, driven and dumped by one man.

BE-18 is 103-in. long, 43-in. high, 43-in. wide, and has a 58-in. wheelbase.

Quick-Change Tip (7)

NEW, TWO-PIECE quick change pinning device for securing tips on No. 8 and No. 9 Rippers can be installed or removed in only one minute, according to Caterpillar Tractor Co.

Each unbreakable pin is flanged at each end and bent slightly in the middle to achieve the locking effect.



Slurry Pump (8)

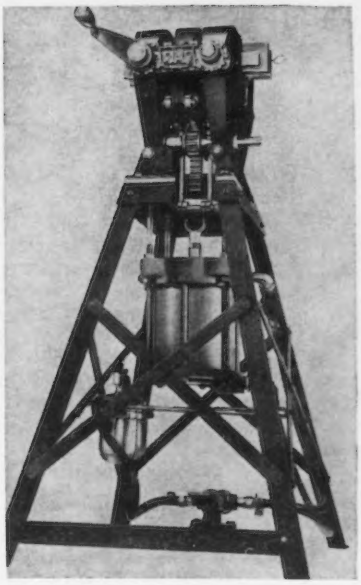
MORRIS MACHINE WORKS announces the development of a new slurry pump, the "JC", which they say has excellent hydraulic and abrasive characteristics and which can approximate the efficiencies of clear water pumps. The "JC" features allow it to operate on minimum horsepower and help extend the long life of its wearing parts. It is easy to maintain and has constant operating reliability.

Beryllium Detector (1)

BERYLLIUM STREAM ANALYZER capable of continuously monitoring a solution or a slurry has been developed by Boulder Scientific Co. In about five minutes, the unit can measure concentrations of beryllium in the microgram-per-millimeter range with 10% accuracy.

As with other beryllium tracing units that have been developed during the past two years, Boulder's detection principle is based on the production of neutrons by the reaction of gamma rays and beryllium followed by an indirect measurement of the emitted neutrons.

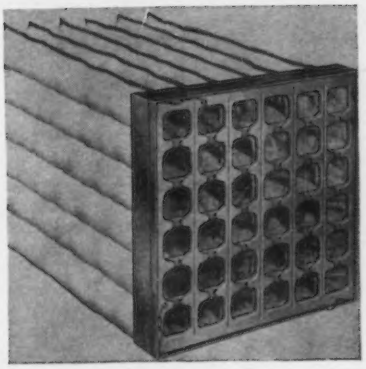
Boulder said the instrument has been approved by the AEC for use with a one curie source in an unrestricted area.



Improved Lacer (3)

CLIPPER BELT LACER CO. has developed an improved lacer which imbeds the hooks flush with the surface—all strain is now distributed across entire joint.

Designed for air pressures of at least 80 psi, the six-in. cylindered lacer is foot-operated, leaving both hands free for belt placement. Clipper said that one man could handle almost any lacing job. Joints up to 12-in. wide can be produced in one simple operation—for wider joints, the procedure is repeated.

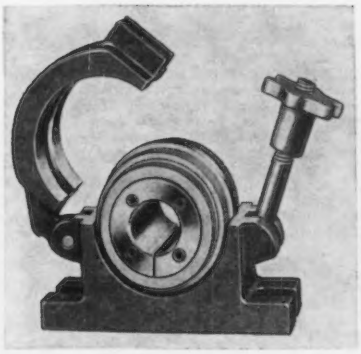


Dry-Type Filter (47)

NEW DRY-TYPE air filter, a unit filter of high efficiency, low resistance, compactness and unusual dust-holding capacity, has been introduced by American Air Filter Co.

The company calls it DRI-Pak and feels that it's revolutionary—it inflates when the ventilation system is in operation and collapses when the system is shut down. With this unique feature, the unit can be inspected and serviced from either the air-entering or air-leaving side of the filter bank. Since no back-up wire is necessary, chances of damaging the filter during installation have been greatly reduced.

The new filter is disposable, extremely light, and requires little storage space. Each 24x24-in. cartridge in the folded state is only 4 in. deep and weighs only 4 lb. After the unit has reached final resistance, the cartridge, including the header, is thrown away.



Pillow Blocks (12)

DODGE MFG. CO. has made new-design pillow blocks that make it much easier to replace bronze precision liners.

The new sleeve bearings, Dodge says, are recommended for applications where shock loads, elevated temperatures and corrosive conditions are anticipated. Company engineers claim that for the first time it's possible to replace a worn bushing or liner without removing the bottom half of the housing from its support. Only the block cap is removed —the shaft is lifted just enough to permit the lower half of the liner to be loosened and slipped out.

Non-Crush Hose (4)

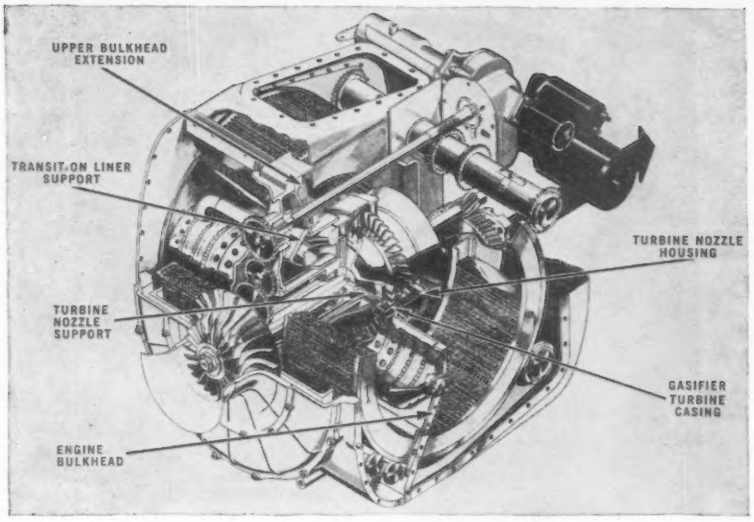
A WATER SUCTION HOSE that's able to spring back to its original shape even if completely crushed—designed especially for use where it is subject to damage from truck movements—is now being marketed by the Goodyear Tire & Rubber Co. The shape is maintained by a specially-treated rope helix embedded in heavy rubber between two plies of fabric.

Goodyear calls the hose "Rebound", and makes it in lengths up to 50 ft and in 1½-in. to 3-in. dia. R. E. Mercer, the company's hose sales manager, said the interior tube is a nonporous rubber compound that resists sand and grit action.

Mechanical Gold Pan (5)

NEW, PORTABLE mechanical gold pan (40x17½x15 in. and weighing about 95 lb) which can process a shovel-full of sand-gravel in less than five seconds, has been developed by H & C Machinery Co.

According to J. W. R. Henderson, Houston, the unit is primarily a shaker box with an attached water pump to provide a sprinkler system. Gold and other high-gravity minerals sink to the bottom of the box and collect at the rear until released by a clean-out plug. Henderson went on to say that it could run for many hours on one gallon of gasoline and that anyone could operate it.



High Alloy Castings for Gas Turbine Engine (50)

WHILE OFFERING several operating advantages that will ensure its acceptance and use on both heavy and light machinery, the gas turbine engine carries with it certain distinct problems. According to the Alloy Casting Institute, GM's Allison Div. has made use of high alloy castings in the design of the GMT-305 Whirlfire regenerative gas turbine engine. The castings were used to combat several of the more severe gas turbine headaches—high temperature, corrosive combustion products and high stress.

GMT-305 is a multi-fuel engine, designed to burn practically any of the normal internal combustion fuels (gasoline, kerosine, or the heavier diesel fuels) and develops 225 hp, which is more than double the output of a comparable piston engine and approximately 70% more power per lb of weight.

Type CF-8C (Alloy Casting Institute designation) is an iron-base, columbium-stabilized, chromium-nickel alloy which can resist corrosion even after being subjected to high temperatures for a long period of time. In the solution heat treated condition CF-8C has an essentially austenitic structure. When exposed to temperatures in the 800-1600°F range for extended periods, columbium carbides are precipitated instead of chromium carbides. This prevents the depletion of chromium along the grain boundary network and the alloy, therefore, is protected against intergranular corrosion attack. Castings of this alloy have good machinability and weldability, high hot strength and a limited creep stress well above GMT-305's operating requirements. Allison engineers used CF-8C castings for six important components in the engine's "hot area"—transition liner support, and gasifier turbine casing, engine bulkhead, turbine nozzle housing and support, and upper and lower bulkhead extension.

The bulkhead, the partition that separates and seals the gasifier section from the power turbine section, is one of the hottest parts of the engine. In addition to the heat, it suffers from distortion caused by the pressure differential of two atmospheres between one side of the wall and the other.

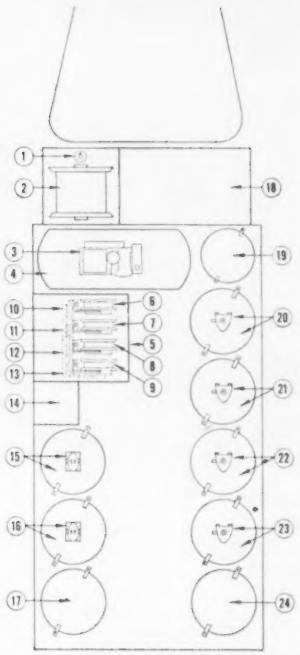
Pressure on the bulkhead's gasifier side is 3½ atmospheres, immediately dropping to 1½ atmospheres on the power side. The Institute said that as a result of prototype testing, drastic design changes were made in the bulkhead assembly. Formerly, it was made of sheet metal sections, fitted and welded together—nearly 20 separate pieces of chromium-iron sheet of the 400 series stainless steel were welded to make a high-cost assembly that was far from satisfactory. Evidences of rapid intergranular corrosion caused Allison engineers to design an assembly composed of only three CF-8C corrosion-resistant castings.

Gasifier turbine casing operates close to the hot combustion gases at a metal temperature of 1100°F. Although the CF-8C casting is a simple ring shape, a large portion of it must be machined to match and fit other castings and components. Good castability and machinability of the alloy make a substantial contribution to the economical production of the entire assembly.

Although the transition liner support (on the bulkhead's gasifier side) is in a slightly cooler zone, its operating temperature is still high enough to put it to great stress—1200°F. The casting is complex and heavy (13¼ lb finished weight) and demands precision machining throughout.

The gasifier nozzle support, Alloy Casting Institute said, operates at a relatively low temperature (600°F) and is one of the simplest (a ¾-in. thick disk) and one of the lightest parts (4.3 lb finished). However, its use calls for high hot strength and resistance to the ever-present hot, corrosive gases.

Whirlfire was installed in a truck that hauled nickel ore at an Ontario open pit. According to the Institute, it was the first time that gas turbine power has pulled a 32-ton load up an 8% grade.



1. Diesel fuel meter with totalizer.
2. Neoprene fuel hose (35 ft) wound on spring primed reel.
3. Gas-driven 15-hp engine with electric starter and battery.
4. Air compressor—25 cu ft.
5. Steel case, housing two decks of spring primed hose reels—four reels to each deck.
6. Air service hose and reel.
7. Water service hose and reel.
8. Gear oil hose and reel.
9. Motor oil hose and reel.
10. Light diesel oil hose and reel.
11. Heavy diesel oil hose and reel.
12. Chassis lubricant hose reel.
13. Trac roll lubricant hose reel.
14. Storage locker.
15. Chassis lubricant drum (55 gal) and high pressure pump.
16. Trac-roll lubricant drum. (55 gal) and high pressure pump.
17. Spare 55-gal lubricant drum.
18. Diesel fuel tank (600 gal).
19. Water tank (80 gal).
20. Gear oil drum and low pressure pump (55 gal).
21. Motor oil drum and low pressure pump (55 gal).
22. Light diesel oil drum and low pressure pump (55 gal).
23. Heavy diesel oil drum and low pressure pump (55 gal).
24. Spare 55-gal lubricant drum.

Off-Highway Lubrication (2)

BY USING portable lubrication rigs, mining companies can cut the down-time necessary to service off-highway equipment, according to the Cypher Co., Pittsburgh.

The rigs, Cypher said, are designed to fit the needs of small, medium or large operations, and are made in various model sizes from small trailer and pickup types to large van models. Because of the rigs' mobility, one man, acting as both driver and operator, can maintain a scheduled lubrication program.

Though Cypher manufactures four basic models (drawing outlines the van rig), its engineering department can design a rig to meet any problem.

For Your Files

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COMPLETE LINE of standard, custom and advance design lever action clutches which give completely safe, automotive-type, smooth start and stop clutching is described in a new 16-page catalog from V-Belt Clutch Co.

Ease of selecting the proper clutch to do the required job is one of the main points discussed in the bulletin, and, according to V-Belt, the format makes selection of their Ball-Lok clutch as simple as choosing a standard pulley of the same size. **(91)**

RADIATION WARNING SYSTEM for any area where radioactive materials are stored, handled or transported is described in new Bulletin GA-2, offered by Nuclear Measurements Corp.

The GA-2 gamma alarm system is a completely self-contained 12x15x 8⅝-in. unit, with detector, power supply, fail-safe and alarm circuits. It's wall-mounted, operates from any 110-volt circuit, and detects, indicates and reports any unusual or excessive gamma radiation. Nuclear Measurements said that any number of GA-2 units may be connected with simple telephone wire into a multi-station system and monitored on a central control room panel. **(92)**

GOODMAN MFG. CO. has just published an eight-page illustrated bulletin to describe their Ropebelt conveyor which features full-flex carrying idlers.

Some of the Ropebelt advantages, Goodman said, are: low-cost installation, extension, relocation; versatility; and low maintenance—resiliency of the Ropebelt structure increases carrying capacity and provides a shock-free operation that results in less wear on belting and idlers.

Bulletin's last four pages contain detailed diagrams of idler construction and teminal sections. **(93)**

COMPREHENSIVE description of the construction and design details of the fractional horsepower Duty Master motor is included in Reliance Electric & Engineering Co.'s eight-page Bulletin B-2514.

Duty Master, according to Reliance, offers a new ventilation system that makes it up to 10% cooler than other comparably rated motors. Weight has been reduced 35% from preceding motor designs. **(94)**

GORMAN-RUPP CO. has prepared a professional, eight-page, four-color bulletin containing specifications, performance, data, cross-section drawing, and other general information on their three-in. electric motor driven submersible dewatering pump. **(95)**

NEW four-page folder describing details, method of operation, and specifications for nuclear gaging systems for liquid, solid, or slurry levels measurement has been prepared by The Ohmart Corp. **(96)**

PORTABLE CABLES for Surface Mining is the title of a technical paper recently published by The Anaconda Wire & Cable Co. The paper reviews the development and application of portable cables and discusses cable requirements, maintenance fundamentals, and repairs—is particularly applicable to the use of electric power shovels in open-pit mines. **(97)**

AMERICAN ZINC INSTITUTE, Inc. has just released a new and definitive 34-page inspection manual governing protective zinc coatings on products hot dip galvanized after fabrication that should be an invaluable aid to inspectors and designers. **(98)**

THOR POWER TOOL CO.'S new 48-page presentation, Contractor and Mining Air Tool Catalog (No. 46), carries a complete equipment line with detailed diagrams and specifications. **(99)**

ROCKWELL - STANDARD'S five-page fold-out plus specification sheet outlines its heavy-duty Stopmaster brake. According to the company, the Stopmaster represents a completely new brake design incorporating many features never before available in heavy-duty equipment. It has less fade, cooler operation, longer lining life; is light, and allows much faster stopping.

Stopmaster is available in 17-, 20¼-, 22-, and 26-in. dia., and in widths ranging from 4 to 10 in.—is especially suited for off-highway tractors and scrapers, cranes and shovels, and heavy-duty trucks. **(100)**

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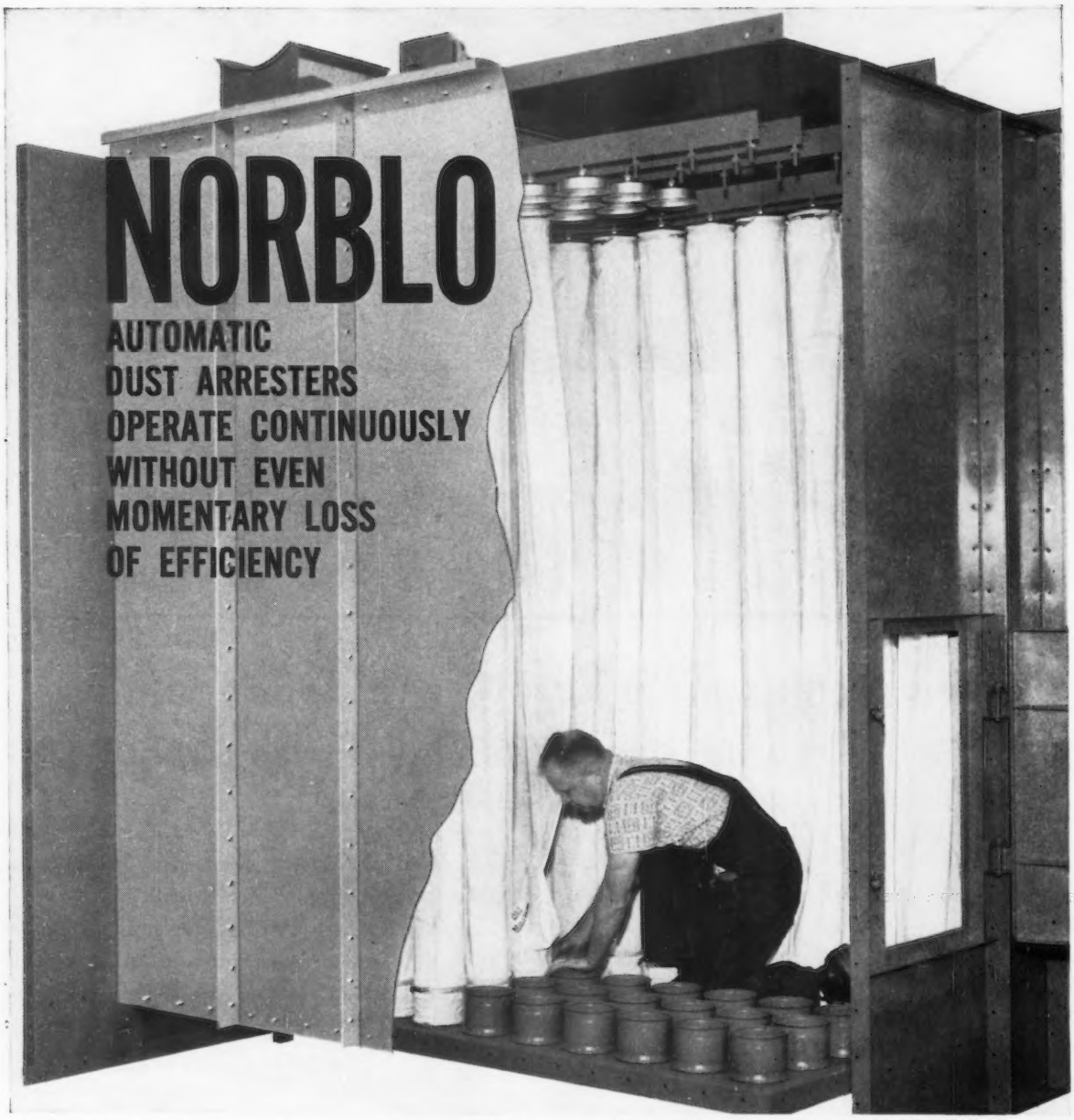
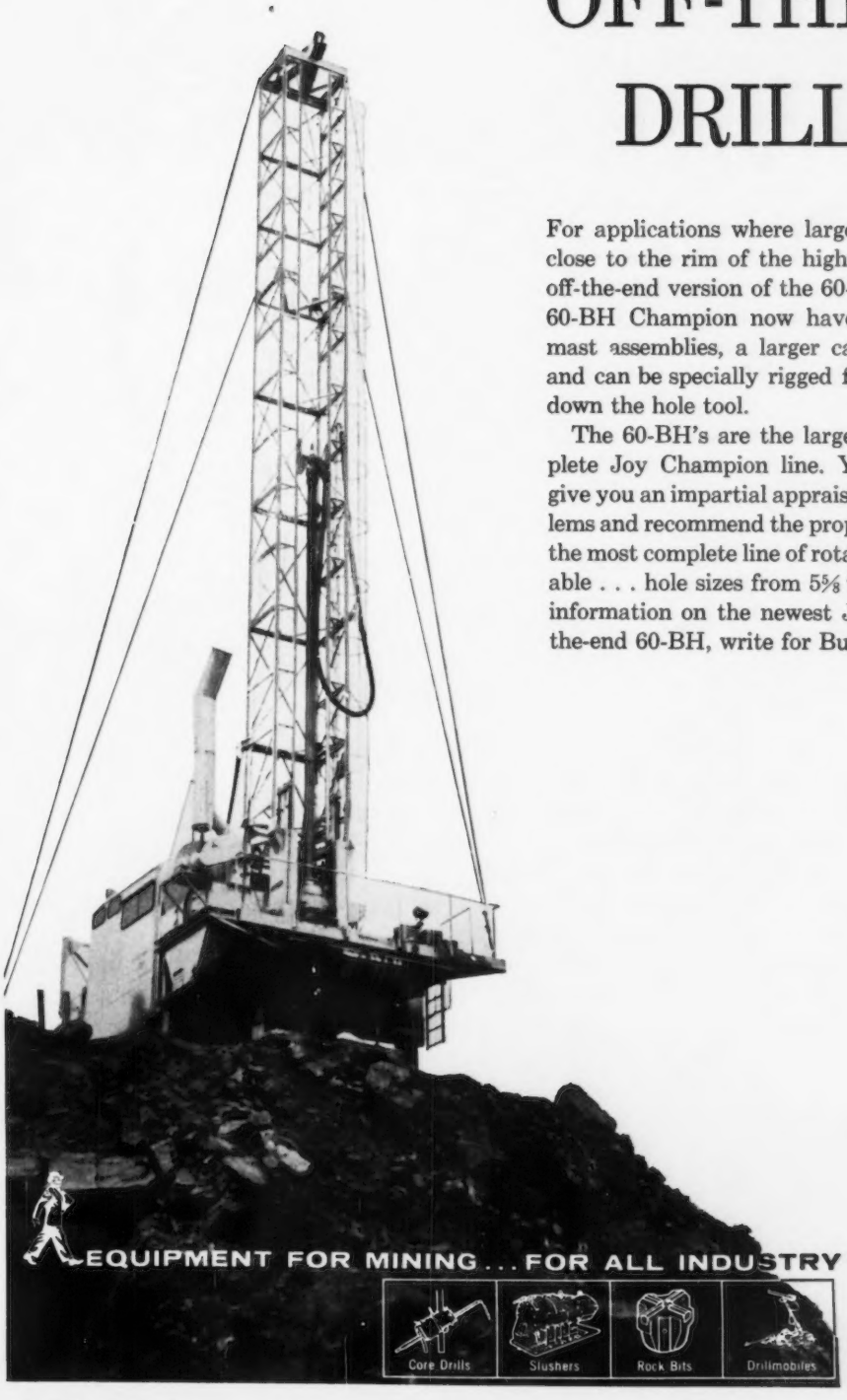


Periodic cleaning, repair or replacement of bags, and minor maintenance can be accomplished while the collector remains in operation. One compartment, as shown above, can be isolated in the Norblo design, with all mechanical parts outside the gas stream. Continuous cyclic shaking, by compartment, allows operation without interruption. ■ This is why in modern plant operations you'll find an increasing preference for Norblo Automatic Bag Arresters. Where efficient production requires continuous operation more and more industries specify Norblo Dust Arresters. Over 80% of the cement industry relies on Norblo equipment for drying, grinding and finishing operations. ■ Buell-Norblo equipment can play an essential part in your process. Write for complete information on any type of dust collection problem. Buell Engineering Company, Inc., Dept. 19-D, 123 William Street, New York 38, New York. Northern Blower Division, 6410 Barberton Avenue, Cleveland, Ohio. Electric Precipitators · Cyclones · Bag Collectors · Combination Systems · Fans · Classifiers.

buell Norblo®

JOY 60-BH CHAMPION

OFF-THE-END DRILLING



For applications where large blast holes are sunk close to the rim of the highwall, Joy offers a new off-the-end version of the 60-BH. All models of the 60-BH Champion now have heavier crawler and mast assemblies, a larger capacity air compressor and can be specially rigged for optional use with a down the hole tool.

The 60-BH's are the largest models of the complete Joy Champion line. Your Joy engineer can give you an impartial appraisal of your drilling problems and recommend the proper Joy Champion from the most complete line of rotary air blast drills available . . . hole sizes from 5⅝" to 12". For complete information on the newest Joy Champion, the off-the-end 60-BH, write for Bulletin 2655-4

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

producing URANIUM in SASKATCHEWAN
or NITRATES in CHILE . . .

NORDBERG ENGINES

continually prove their reliability and economy

Neither bitter cold, nor inaccessible location could stop the successful development of a strategically valuable uranium ore deposit by Gunnar Mines, Limited, located in northwest Saskatchewan, less than 450 miles south of the Arctic Circle.

To meet their electrical power requirements, Gunnar chose seven Nordberg Supairthermal® 4-cycle diesel engine-generator units, each rated 1200 hp at 450 rpm, direct connected to 845 kw generators. Adding to the efficiency of this installation are waste heat boilers which utilize exhaust gas from the Nordberg engines to produce steam for heating plant buildings.

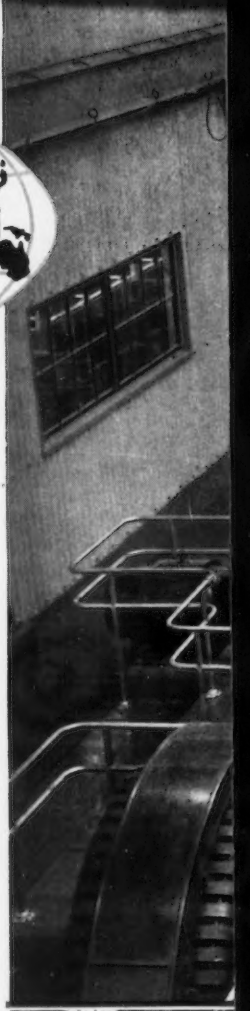
* * *

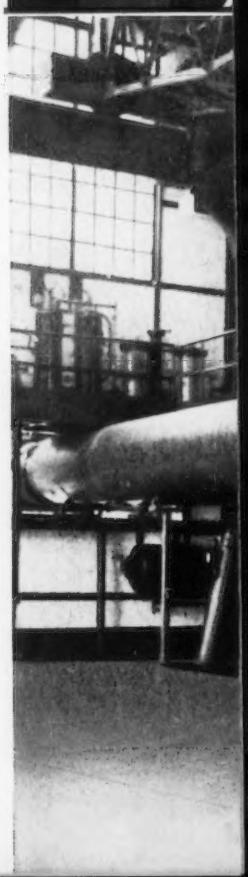
● The story of power plant expansion for Anglo-Lautaro Nitrate Corporation's vast operations in northern Chile is largely a story of reliable Nordberg power. Their original Nordberg engine was a 7100 hp diesel unit installed in the Pedro de Valdivia plant, followed by the installation of two 1900 hp Nordberg diesels for the plant at Maria Elena. Then, to meet much needed additional power, two big 9600 hp Nordberg diesels were installed in a new power plant at Coya Sur.

Anglo-Lautaro has again turned to Nordberg to meet further power expansion, and is installing *five more* Nordberg diesels, each rated 5750 hp, in the Pedro de Valdivia power plant. The combined capacity of all ten Nordberg engines will provide over 38,000 kilowatts for nitrate production.

* * *

While these particular power assignments are widely separated geographically, they are striking examples of the way in which Nordberg engines produce power for the world's major industries . . . many of which are in remote, inaccessible areas where dependable operation is of prime importance.





NORDBERG MACHINERY

NORDBERG MANUFACTURING COMPANY
Milwaukee 1, Wisconsin

ATLANTA • CLEVELAND • DALLAS DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS
NEW ORLEANS • NEW YORK • ST. LOUIS • SAN FRANCISCO • TAMPA • WASHINGTON
WICHITA, KAN. • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

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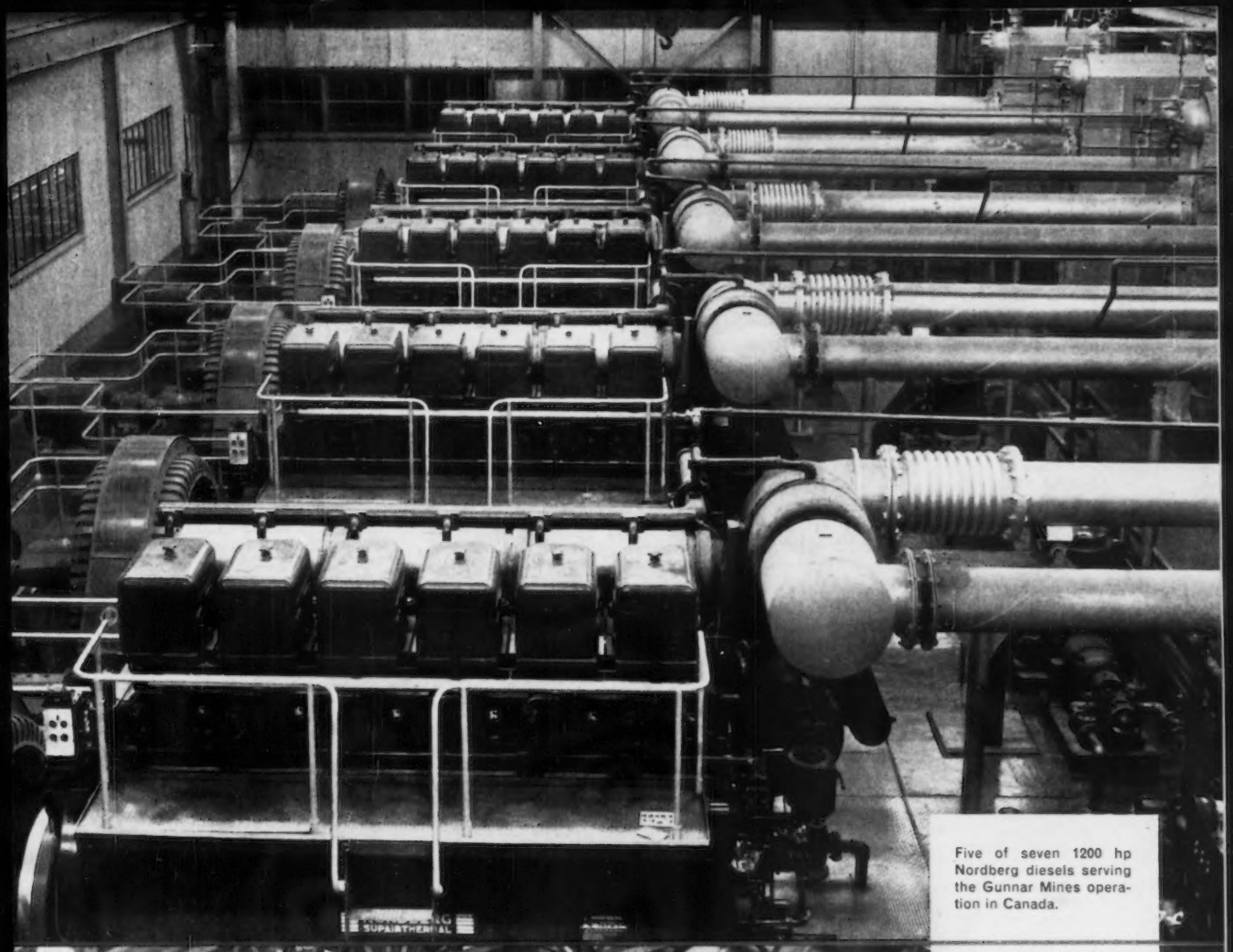
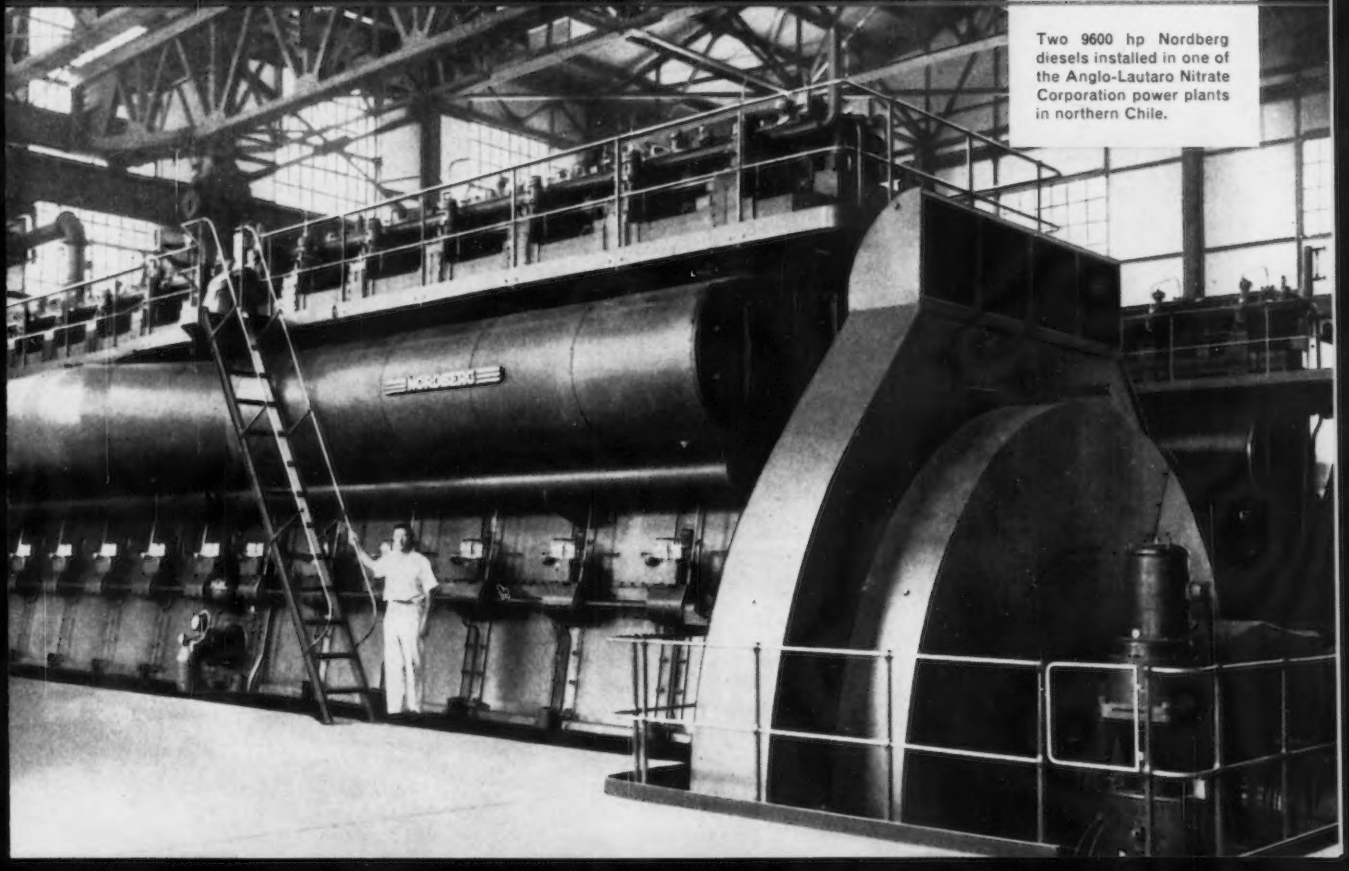
P959-R



Five of seven 1200 hp Nordberg diesels serving the Gunnar Mines operation in Canada.



Two 9600 hp Nordberg diesels installed in one of the Anglo-Lautaro Nitrate Corporation power plants in northern Chile.

'61 FORD TANDEM AXLE TRUCKS

BROADER WARRANTIES... GREATER DURABILITY... BIGGER CHOICE!

FORD DIVISION, *Ford Motor Company*

- **New Super Duty V-8 Dealer Warranty—100,000 miles or 24 months!**
- **New extended Dealer Warranty for entire truck line—12 months or 12,000 miles!**
- **New stronger frames and huskier cabs!**

Ford's rigid quality control program gives you unsurpassed dependability! Positive evidence of uniformly high production and inspection standards is the exclusive new 100,000-mile engine warranty. On 401-, 477- and 534-cu. in. Super Duty V-8 engines, each major engine part (including block, heads, crankshaft, valves, pistons, rings), when engine is used in normal service, is warranted by your dealer against defects in material or workmanship for 100,000 miles or 24 months, whichever comes first. Warranty covers the full cost of replacement parts . . . full labor costs for the first year or 50,000 miles, sliding percentage scale thereafter.

In addition, an extended warranty covers all 1961 Ford Trucks of any size. Each part, except tires and tubes, is now warranted by your dealer against defects in material or workmanship for 12 months or 12,000 miles, whichever comes first. The warranty does not apply, of course, to normal maintenance service or to the replacement as normal maintenance of such items as filters, spark plugs and ignition points. No other truck gives you such protection for your investment; never before could you be so confident of long-range durability!

Tougher tandems offer greater strength in chassis, cab and sheet metal for longer life. Full-Torque flywheel power take-off is available for more efficient drive of transit mixers and heavy-duty equipment.

Timken or Eaton rear axles are available in all Super Duty tandems with capacities up to 38,000 lb. High capacity front axles have wider track for increased stability when cornering or in rough terrain.

GVW's up to 51,000 pounds permit big, profitable payloads. Heavier gauge metal and stress-isolating independent mounting for radiator, fenders and cab give you greater durability.

Tilt Cab models are available with tandem rear axles. As with conventional tandems, aluminum walking beams, wheels and fuel tanks are offered to cut weight, boost payload.

QUALITY-BUILT... MAINTENANCE-ENGINEERED

FORD TRUCKS COST LESS

THE USEFULNESS OF A LIMA

6 or 8-yd. Lima Type 2400 Shovel, shown on a stripping operation in Pennsylvania.

Toughest mantle rock can't stop Limas

Limas are job-designed and built from the ground up for high output stripping and loading. They remove overburden fast and easy for high-speed loading of coal and ore. These are some of the reasons Lima's big, bold Type 2400 is a high-production mining favorite everywhere:

- **CRAWLERS** — Wide, long for extra stability; steered through air-controlled jaw clutches for easy handling
- **MAIN MACHINERY** positioned to hold counterswing to minimum, allow faster swing
- **DRUMS**—Extra wide, tandem mounted for more cable capacity, longer cable life
- **ANTIFRICTION ROLLER BEARINGS** reduce wear at all important bearing points
- **AIR-CONTROLLED CLUTCHES** are extra large; give instant response
- **TORQUE CONVERTER** reduces shock loading, prevents stalling . . . lengthens cable life, lowers maintenance
- **PRECISION AIR CONTROL** lets operator feel action without fatigue; means more output, greater efficiency

Judge the 2400 for yourself — ask your nearby Lima distributor for a free copy of the 32-page bulletin describing the 2400 in detail . . . or write to us here in Lima.

There's a Lima type and size for every mining operation — shovels to 8 yd.; draglines variable; diesel or electric.

LIMA Construction Equipment Division, Lima, Ohio

BALDWIN · LIMA · HAMILTON

6111

Shovels • Cranes • Draglines • Pullshovels • Roadpackers • Crushing Equipment • Asphalt Plants

NEW PLASTIC SHELL CASE

Now standard on all Republic Bail-Type Roof Bolts

Already a preferred product among leading mine operators, Republic Mine Roof Bolts now offer another new, advanced feature—polyethylene shell cases for bail-type bolts. Standard on all Republic Bail-Type Roof Bolts at no extra cost.

PROTECTS SHELLS IN STORAGE—SIMPLIFIES HANDLING AND INSTALLATION. The new shell case is unaffected by moisture and corrosive conditions often present in mine storage areas—protects against shell damage and lost parts. The plastic case can be left on the shell when installed, makes installation faster and easier.

RED SHELL CASE—MARK OF QUALITY. Republic Bail-Type Roof Bolts can be identified at a glance. The bright red shell case, a Republic exclusive, tells you that it's a Certified Quality Republic Bolt. Steel chemistry, yield point and break point are known quantities for predictable, top performance at lowest cost.

To meet specific conditions in your mines, Republic offers the largest selection of roof bolts available anywhere. Field trained Republic Mine Roof Bolt Engineers are available to work with you in selecting the best bolt for your requirements. Send the coupon for more information on Republic Roof Bolts and obligation-free field service.

REPUBLIC STEEL

REPUBLIC HAS THE FEEL FOR MODERN STEEL

REPUBLIC STEEL CORPORATION
DEPT. EJ-2131
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send further information on:

☐ Republic Roof Bolts ☐ Republic Roof Bolt Field Service

Name _____ Title _____

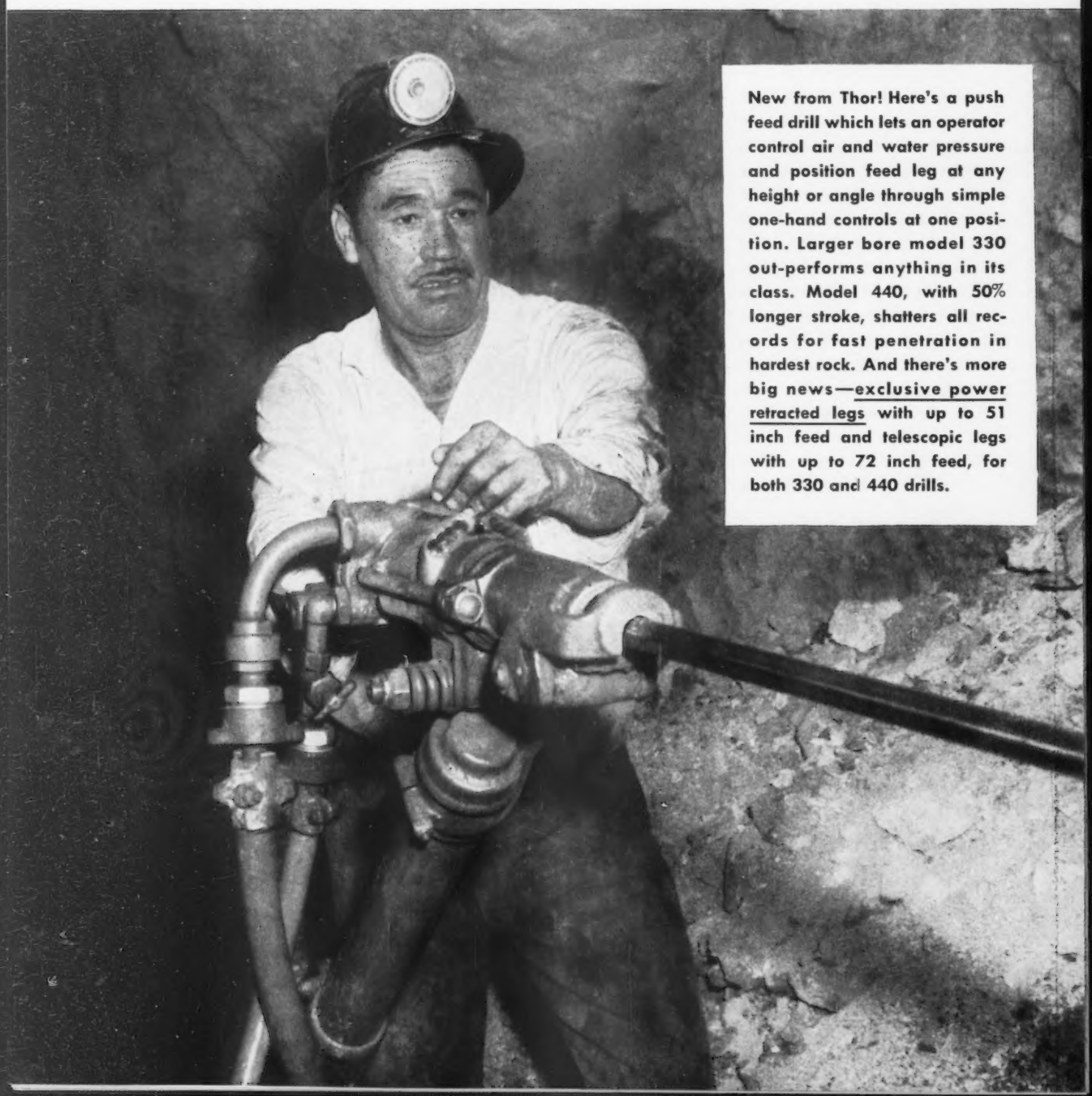
Company _____

Address _____

City _____ Zone ___ State _____

New power retractable and telescopic legs
for faster penetration, increased tonnage

THOR AIR ROCK DRILLING EQUIPMENT



New from Thor! Here's a push feed drill which lets an operator control air and water pressure and position feed leg at any height or angle through simple one-hand controls at one position. Larger bore model 330 out-performs anything in its class. Model 440, with 50% longer stroke, shatters all records for fast penetration in hardest rock. And there's more big news—exclusive power retracted legs with up to 51 inch feed and telescopic legs with up to 72 inch feed, for both 330 and 440 drills.

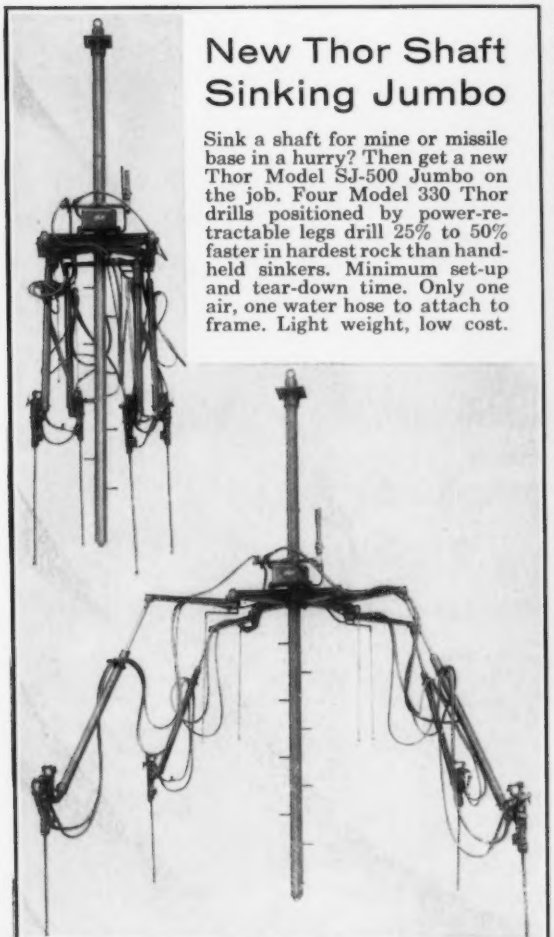
You'll find modern Thor rock drilling systems continually at the forefront of important mining and quarrying jobs everywhere. Why? Reason's simple. Innovations in world famous Thor equipment see to it your drilling speed is increased, power is balanced, performance smooth, air economized, maintenance held to a minimum. And all for a bigger profit picture for you, less fatigue to your operators. Demonstration? Your Thor "Red Tool" distributor and your nearest Thor factory representative are in the Yellow Pages. Or write us. Thor Power Tool Company, Aurora, Illinois.

MEASURED AIR means fastest footage. Thor's model 75 hand-held rock drill sinks holes up to 20 ft. in hardest rock. Wet or dry operation. Exclusive Thor air valve admits exact amount of air required, assuring maximum economy.

"PAID FOR ITSELF on roof bolting operations alone," that's what an underground quarry operator had to say about Thor's TR-5 crawler rock drill. Rigged with extended boom, the Thor crawler drilled up to 200% more holes per day than competitive models.

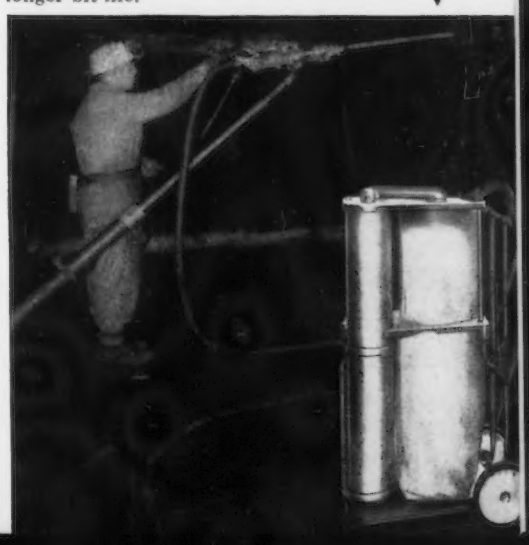
New Thor Shaft Sinking Jumbo

Sink a shaft for mine or missile base in a hurry? Then get a new Thor Model SJ-500 Jumbo on the job. Four Model 330 Thor drills positioned by power-retractable legs drill 25% to 50% faster in hardest rock than hand-held sinkers. Minimum set-up and tear-down time. Only one air, one water hose to attach to frame. Light weight, low cost.



Shaft Jumbo designed to drill up to an 18-foot diameter. Easily folds to pass through a 4-foot by 4-foot compartment. Frame provides support and all necessary power. Pneumatic support column maintains correct upright position.

DRY, DUSTLESS AND DYNAMIC sums up the new Thor model 390-DL dustless push feed drill. Dust and fragments are siphoned off by high velocity reversed air action through the hollow steel. No mess, more production, longer bit life.



Thor POWER TOOLS

THOR POWER TOOL CO., AURORA, ILL.

ATLANTA • BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DENVER
DETROIT • HOUSTON • INDIANAPOLIS • KANSAS CITY, MO. • LOS ANGELES • MILWAUKEE • NEWARK
NEW YORK CITY • PHILADELPHIA • PITTSBURGH • RICHMOND • ST. LOUIS • SAN FRANCISCO
SEATTLE • TORONTO, ONT., CAN. • EXP. DIV., NEW YORK CITY

Even in the remotest mining areas, ruggedness and freedom from service problems are ***musts*** *for crushers*

■ That's why the BIRDSBORO-BUCHANAN trademark is a familiar sight to natives in mining operations of many countries throughout the world. Management in these remote areas must be extremely careful in their selection of important equipment. Recently added to the long list of foreign installations of BIRDSBORO-BUCHANAN Deep Frame Jaw Crushers is the patented 42″ x 48″ unit now turning out 400 tons per hour in the Hierre de Arcari Iron Ore Mine in Peru. This heavy duty crusher was specifically designed to provide continuous trouble-free service.

Your Birdsboro representative can give you the profit-producing details for your own operation. *Sales Department, Engineering Department and Mfg. Plant:* Birdsboro, Pa.
District Office: Pittsburgh, Pa.

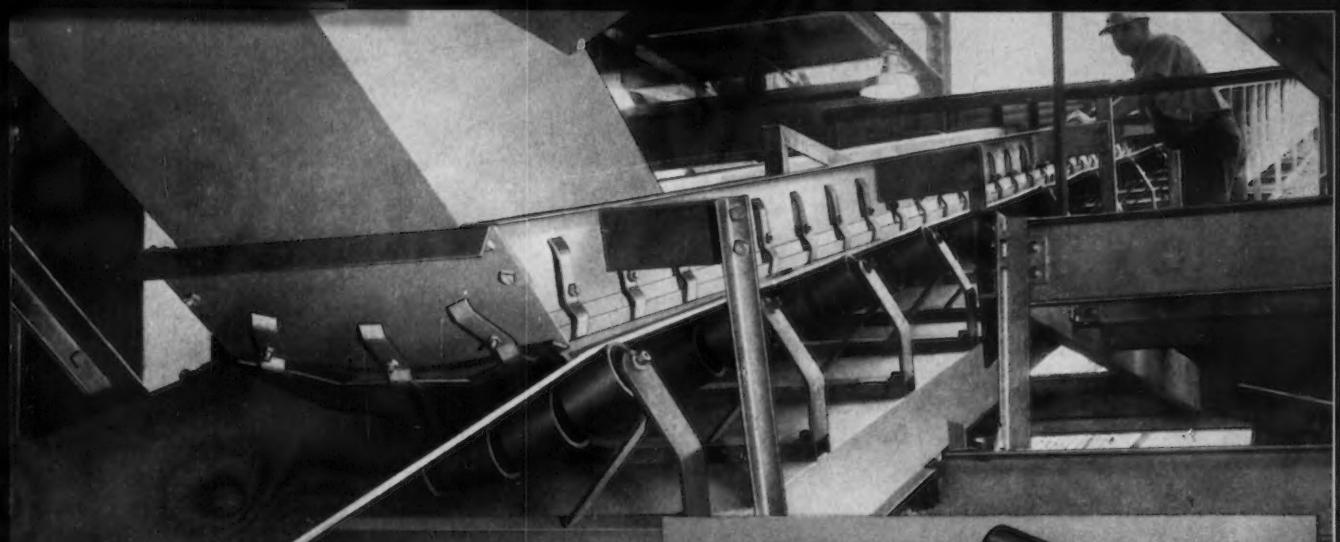
Canadian Representative & Manufacturer: John Inglis Co., Ltd., Toronto, Canada.

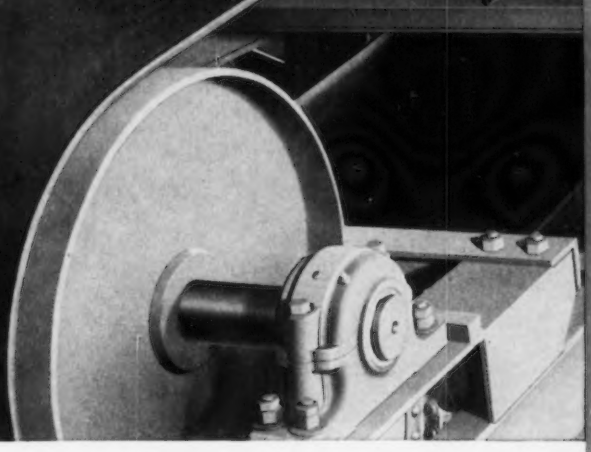
World-Wide Agent Representation. Contact home office for nearest representative.

CR 29-60

BIRDSBORO
CORPORATION BIRDSBORO, PENNA.

STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • ROLLS • ELECTRIC STEEL CASTINGS: Carbon, Low Alloy and STAINLESS STEEL





The Cable does not rotate!
McNally Pittsburg cradle idler design eliminates twists, harmonics–for only the rollers rotate.

That's why you get Greater Belt Life... Less Maintenance

McNally Pittsburg conveyor design adds big tonnage to your belts, cuts power costs, spares you many dollars in maintenance time and replacement parts. The secret of these savings lies in the patented cradle idler design. Big 5″ rubber rollers are suspended in a true catenary, on flexible, stainless steel wire rope. They follow the belt contour, deliver deep troughing action, extend belt life and cut spillage.

Only the rollers rotate. The wire rope is supported at each end by a simple ball joint. It moves freely, adjusts to any belt contour, and provides uniform belt support without any bends or creases. Since the rope does not rotate with the rollers, harmonics are eliminated. The rollers ride on precision-ground ball bearings, which are prelubricated and sealed for life. And you can replace the rollers one at a time if they wear. Easy to erect and maintain—costs less to operate.

McNALLY • PITTSBURG CONVEYORS

McNally Pittsburg Manufacturing Corporation—
Manufacturing Plants: Pittsburg, Kansas • Wellston, Ohio
Engineering and Sales Offices: Chicago • Rio de Janeiro
Pittsburg, Kansas • Wellston, Ohio

Write Today

McNally Pittsburg Mfg. Corp.
Dept. EMJ
Pittsburg, Kansas

☐ Please send information on the new McNally Pittsburg Belt Conveyor.

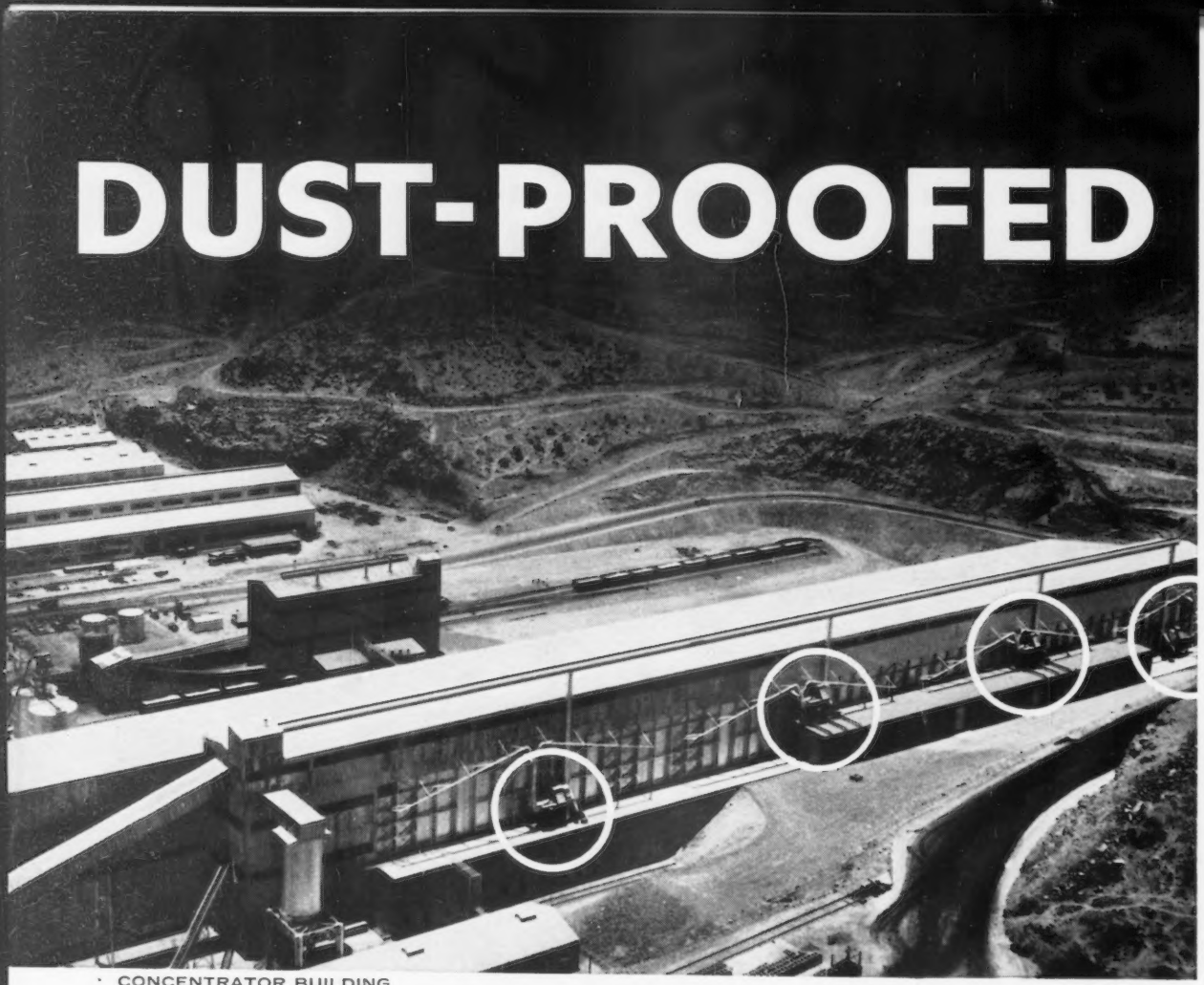
☐ Have Sales Engineer call for further consultation.

NAME_____ TITLE_____

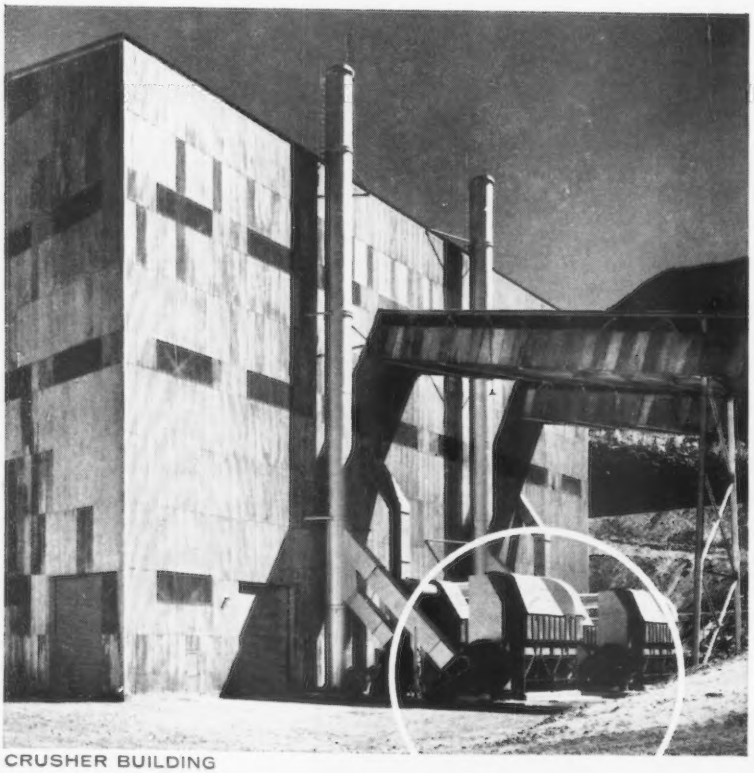
COMPANY_____

CITY_____ STATE_____

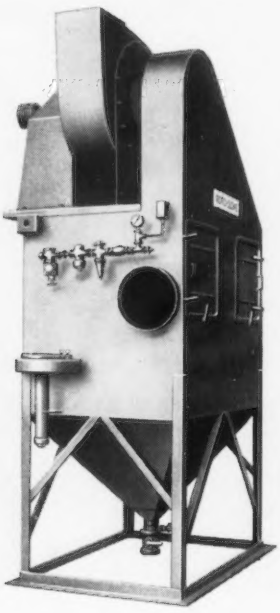
DUST-PROOFED



CONCENTRATOR BUILDING



CRUSHER BUILDING



AAF TYPE N ROTO-CLONE
Arrangement D

BY AAF

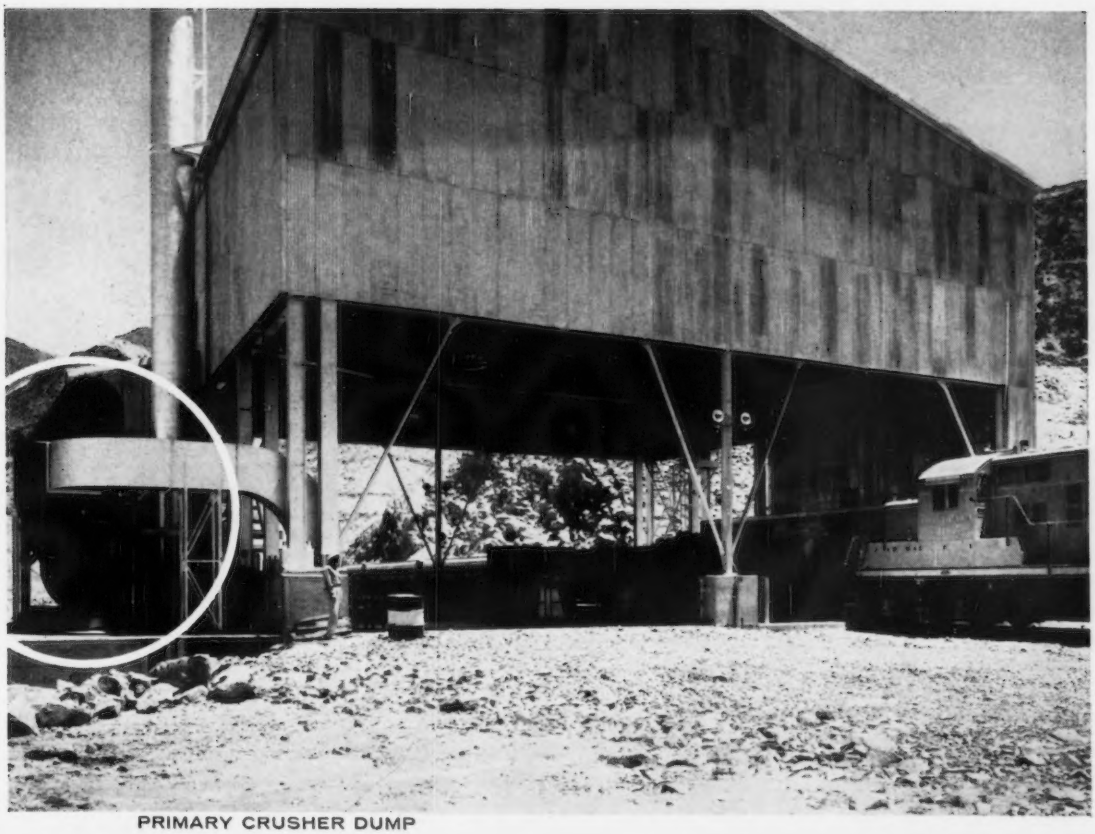
ROTO-CLONES keep processing dust-free for Southern Peru Copper Corporation

DUST doesn't have a chance here. It's fighting a losing battle against an even dozen AAF Dust Control units totalling 348,000 cfm. Wherever dust appears – primary crusher dump, primary crusher feed, intermediate ore storage, secondary crushers and concentrator operations – wet-collecting Type N ROTO-CLONES turn it into a harmless slurry.

AAF engineered dust control systems are an important part of every major ore processing plant in operation today. The reason: a complete line of equipment plus AAF's wealth of application experience.

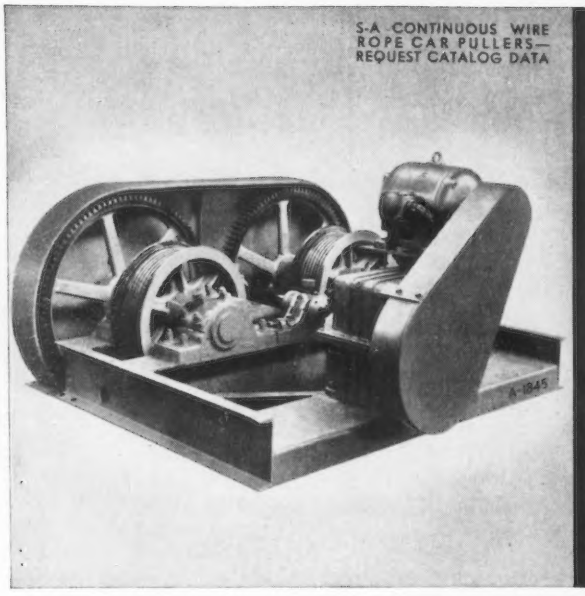
For complete information on the solution to your dust problems contact your local AAF representative, or write direct for Type N ROTO-CLONE Bulletin 272. Address: Mr. Robert Moore, American Air Filter Company, Inc., 193 Central Ave., Louisville, Ky.

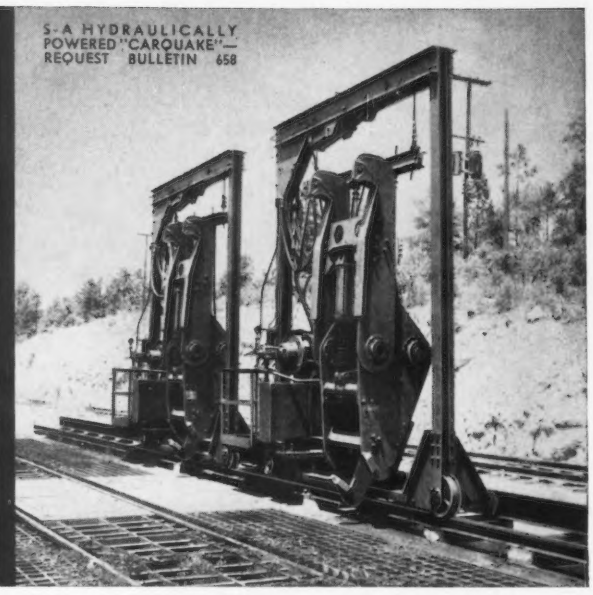
AAF American Air Filter
BETTER AIR IS OUR BUSINESS



PRIMARY CRUSHER DUMP

STEPHENS-ADAMSON





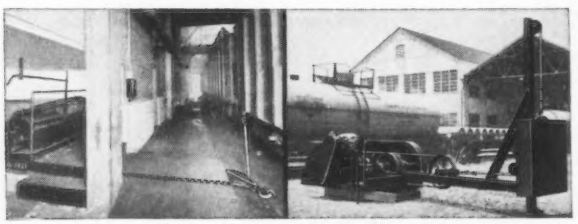
SPEEDS THE SPOTTING AND UNLOADING OF RAILROAD CARS

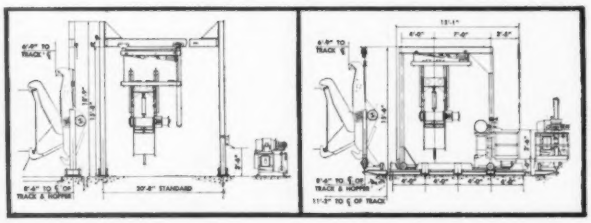
CONTINUOUS CAR PULLERS

S-A Continuous Type Wire Rope Car Pullers are cutting costs at many plants by speeding up loading and unloading of all types of railroad cars. Designed for installations requiring long hauls, cars can be moved in either direction on straight or curved tracks. Since each installation requires careful consideration, we suggest you let S-A Engineering Know-How help solve your specific problem.

HYDRAULICALLY POWERED "CARQUAKE"

One man easily unloads hopper-bottom railroad cars quickly, efficiently and with less noise than overhead car shakeouts. Hydraulically powered vibration utilizes controlled speed to match required capacity. The S-A "CARQUAKE" requires no expensive overhead structures . . . a completely self contained unit—unlimited movement parallel to track. The installation of an S-A "CARQUAKE" avoids demurrage charges —saves manpower—speeds unloading operations.





MODEL 963 DRUM TYPE WIRE ROPE CAR PULLER
Available in three sizes for heavy duty pulling and hoisting for rope pulls from 9,000 to 22,500 pounds. The pulling rope is deadended to drum, which holds enough rope to pull loads over distances of 250 to 500 feet. Where cars must be pulled and lowered on inclines, motor can be reversible.

MODEL 967 DRUM TYPE WIRE ROPE CAR PULLERS
Available in six sizes with rope pulling capacities up to 15,000 pounds. Pulling rope is deadended to drum, which holds enough rope to pull loads over distances of 390 to 727 feet. Where cars must be pulled and lowered on inclines, drive motor can be reversible.

TYPE "B" STATIONARY MOUNTED CARQUAKE
Designed for applications where only slight movement parallel to hopper cars and tracks is required. The unit is mounted to the customer's concrete hopper foundation or steel structure with anchor bolts.

TYPE "C" RAIL MOUNTED CARQUAKE
Mounted on rails permitting travel any desired distance and unloading into any hopper. Concrete piers or steel structure for anchoring rails are all customer need furnish.

WRITE FOR LITERATURE LISTED

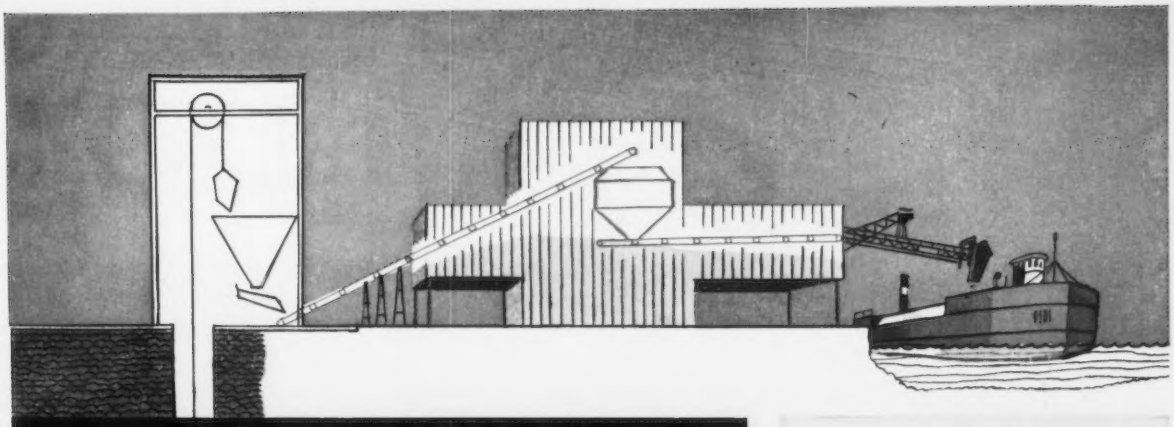
S-A
ENGINEERED BULK HANDLING SYSTEMS
MATERIALS HANDLING PRODUCTS
SPEEDWALK® PASSENGER CONVEYORS
SEALMASTER® BALL BEARING UNITS
SPHERCO® BEARINGS & ROD ENDS

ENGINEERING DIVISION

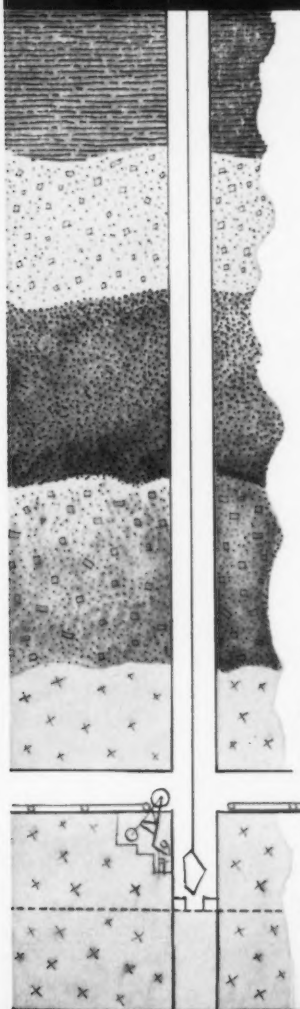
STEPHENS-ADAMSON MFG. CO.

GENERAL OFFICE & MAIN PLANT, 4 RIDGEWAY AVE., AURORA, ILL.

PLANTS LOCATED IN: LOS ANGELES, CALIF. • CLARKSDALE, MISS.
BELLEVILLE, ONT. • MEXICO CITY, D. F.



Surfacing the SALT OF THE EARTH



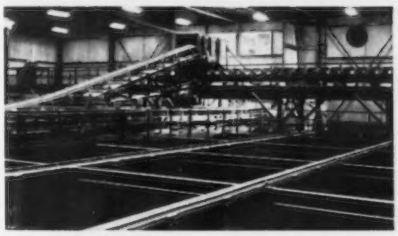
The International Salt Company's $11,000,000 operation on Whiskey Island, Cleveland, Ohio, is a perfect example of modern, efficient bulk handling methods to provide the ultimate in customer service. For this operation, the Bulk Systems Division of Jervis B. Webb Company furnished 28 belt conveyors and shuttles, and one high capacity shiploader for the new surface plant.

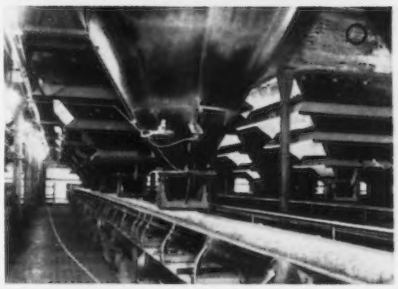
THE PRIMARY BELTS, from the production shaft into the storage area, are 36″ wide with a 700 ton per hour capacity. This includes a large traveling bridge conveyor for loading into the 36 compartment storage bins.

THE SECONDARY BELT CONVEYOR SYSTEM, handling the salt from the storage area, consists of 30″ belts @ 400 TPH, including 7-30″ shuttle conveyors for distributing the product to railroad cars and trucks.

THE TEMPORARY BELT CONVEYOR SYSTEM consists of 7-24″ belts and 1-30″ belt. These belts, along with crushing equipment installed by Bulk Systems, will eventually be reinstalled underground when sufficient salt has been removed to make room for the equipment.

- **Main 36″ inclined belt from production shaft surge bin to top of storage buildings is housed within a totally enclosed gallery structure.**
- **Traveling bridge conveyor consists of a movable tripper running fore and aft over the storage area with a reversible cross-belt shuttle mounted on the tripper structure to receive the discharge from main belt and feeding the salt into the storage pockets right and left.**
- **Detail of some of the 30″ collecting belts under the 36 storage pockets. Conveyors are horizontal and reversible. All gates on underside of the pockets are air operated and remote controlled.**
- **48″ wide 1250 TPH shiploader which is fed from 48″ conveyor. The shiploader extends and retracts, with vertical boom-end movement to follow rise and fall of the ship. Salt is continuously weighed while being carried by this system.**





BULK SYSTEMS • DIVISION OF JERVIS B. WEBB COMPANY

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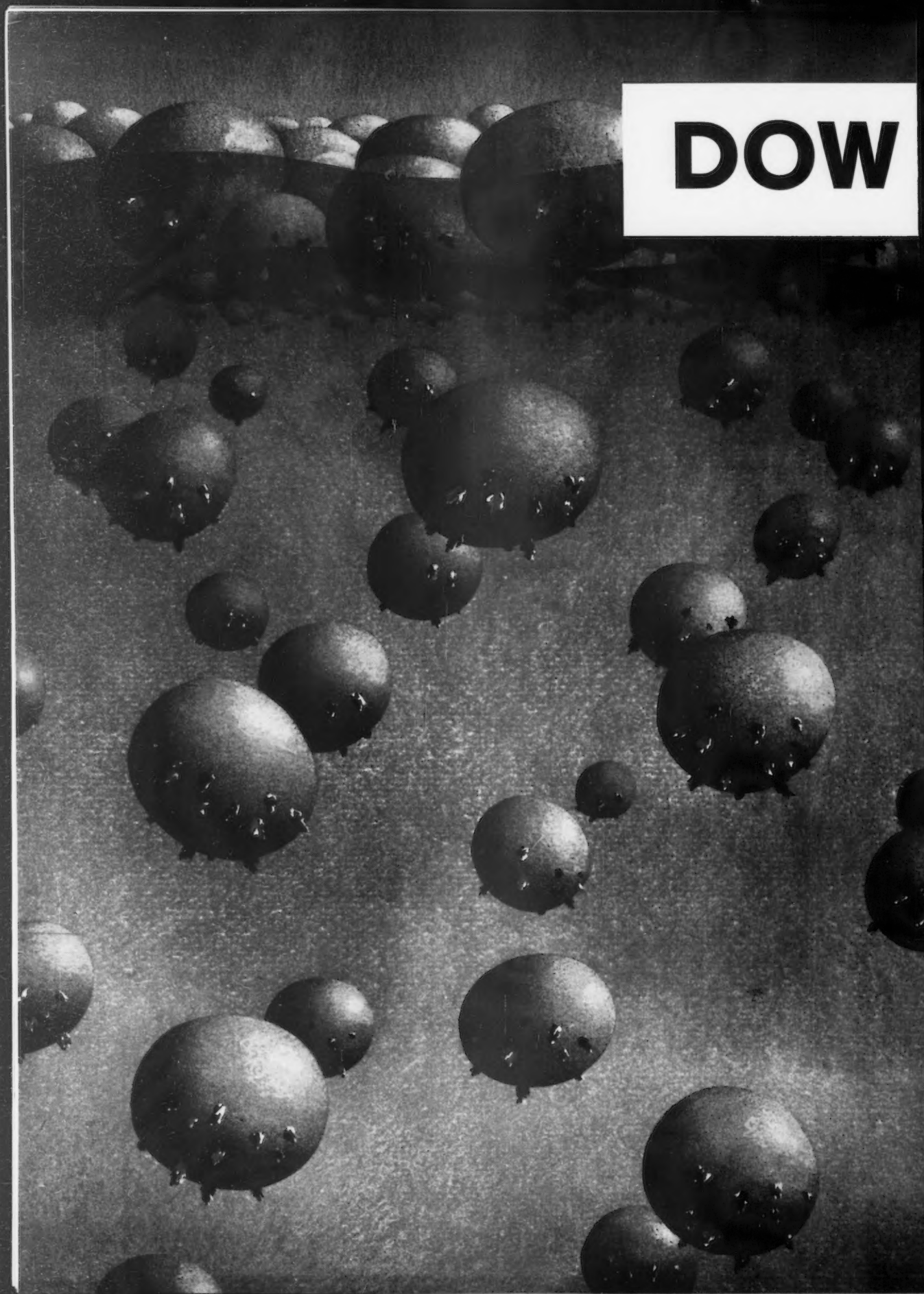

DOW

mining chemicals

DOWFROTH and XANTHATES

SWITCHING XANTHATES MAY CUT COLLECTOR COSTS

COLLECTOR POWER with xanthates is usually considered to be in direct proportion to the number of carbon atoms in the alkyl radical. For this reason, Z®-11 sodium isopropyl xanthate should be, and usually is, a more effective collector than the ethyl xanthates. In many flotation circuits, substituting the newer Z-11 has resulted in a definite reduction in the amount and cost of collector required.

Because of its high collecting power and low cost, Z-11 has become the most widely used collector of all. In any new testing program, Z-11 should receive first consideration—followed by Z-4 sodium ethyl xanthate and Z-6 potassium amyl xanthate. In any process as complex as flotation, however, exceptions are common and eventually all the xanthates should be evaluated.

For some flotation separations it is often advantageous to use a combination of *two* xanthates. For example, one of the ethyl xanthates, Z-3 or Z-4, may be used with an amyl xanthate, Z-5 or Z-6. As ore changes occur, varying quantities may be fed as required to maintain optimum metallurgical results.

Z-200, newest of the Dow flotation agents, is the result of a long search for a better collector for iron-copper separation. Z-200 is a water-insoluble liquid stable in both acid and alkaline pulps. Extensive mill use has confirmed that this product is the most selective copper or copper-activated zinc mineral collector available to flotation metallurgists today. The frothing action of Z-200 often demonstrates a substantial cost saving by reducing frothers required.

ON FRAGILE FROTHS, GANGUE DROPPAGE, AND RUBBER RUIN

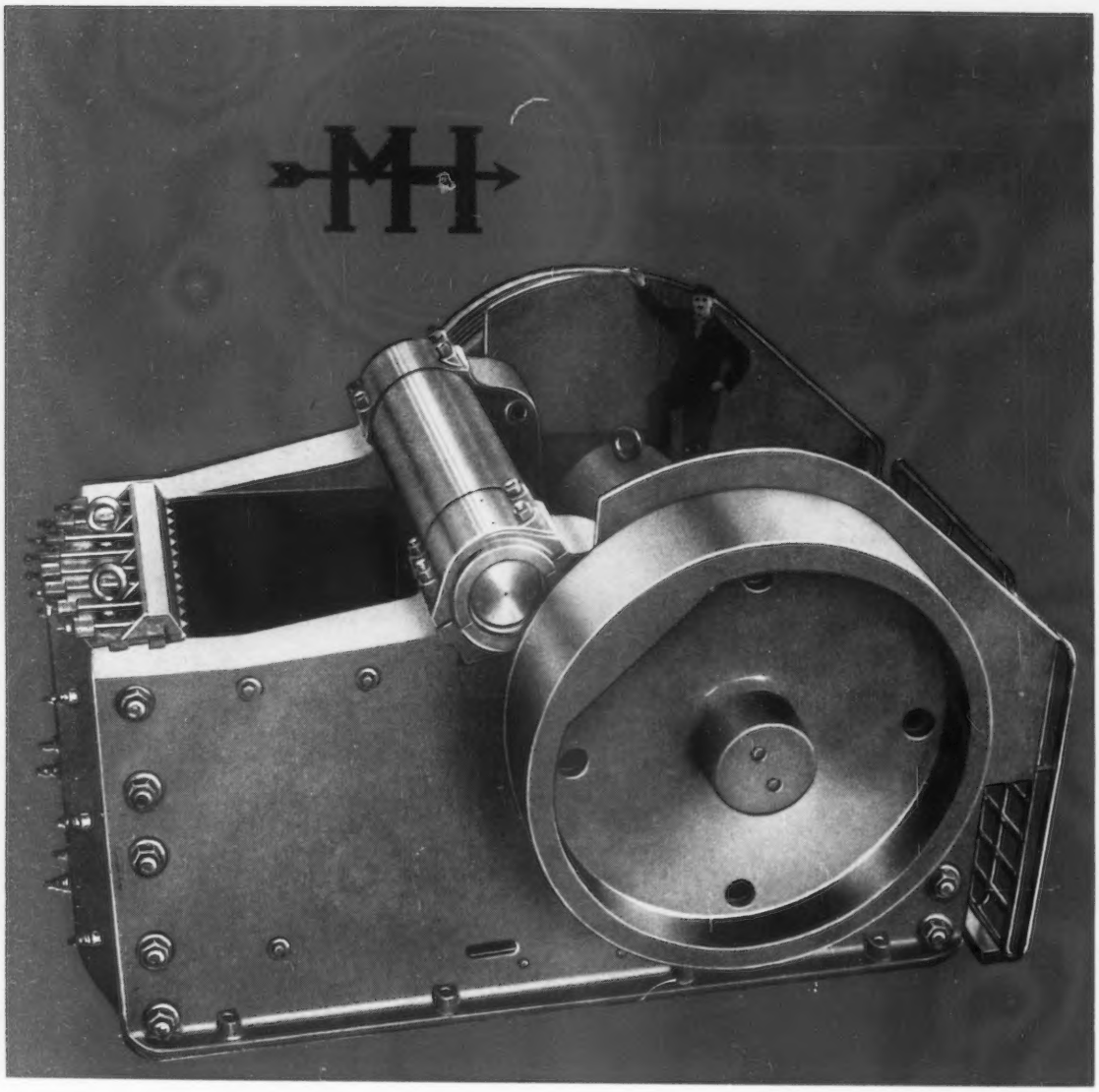
SINCE DOWFROTH® flotation products are completely soluble in water, they may, like Dow xanthates, be added at any required point in the flotation circuit. This also makes the action of Dowfroth especially rapid and more easily adjustable to ore variations. Prolonged flotation stages are possible, giving a good, live froth at the tailing end of the machines with a limited number of frother additions. But despite its stability in the flotation circuit, a froth produced with Dowfroth is easily broken in the launders. The quantity of wash water going to the concentrate launders can also be materially reduced since only a small amount is required to move the froth.

Gangue droppage, being directly related to froth character, is especially good with Dowfroth. Previously used frothers frequently required deep froth columns to allow for gangue droppage, but the fragility of froths produced with Dowfroth yield equal or superior results with greatly reduced froth depth. The result: the effective volume of the flotation machine is increased and greater ore tonnage can be obtained with a given unit.

Frother attack on rubber-covered impellers, stators, and pumps frequently causes swelling and deterioration of the rubber, cutting efficiency and increasing maintenance. A comparison of Dowfroth 250 with other frothers shows that Dowfroth 250 is the least reactive on either synthetic or natural rubber.

Since ores have a way of changing just when you have everything going nicely, Dow maintains a special group of mining and milling experts who can be most helpful when problems arise. Their services are available either in writing or in person. They will be happy to assist you in any problem having to do with mining chemicals. For a copy of our new digest, *Chemicals for the Mining Industry*, write to THE DOW CHEMICAL COMPANY, Abbott Road Buildings, Midland, Mich., Attn: Chemicals Merchandising Dept. 751BD4.

THE DOW CHEMICAL COMPANY DOW Midland, Michigan



Blake Jaw Crusher

For Primary Crushing we can supply Blake Jaw Crushers in all sizes up to 84″×66″ intake.

SKF ball bearings are fitted as standard in the eccentric shafts and frames of all models.

The picture shows a Blake Jaw Crusher No. 19 with an intake opening of 84″×60″.

MORGÅRDSHAMMAR

MORGÅRDSHAMMARS MEK VERKSTADS AB • MORGÅRDSHAMMAR

Sweden

BOSTRON

THE BELT WITH THE HAZARD-PROOF CARCASS!

WILL NOT ROT OR MILDEW — Constantly running salt water cannot rot or mildew 2-ply BOSTRON belt at J. H. Miles Co., Norfolk, Va. No deterioriation from fastener rust, no fastener holding problems.

OUTSTANDING WEAR — Constant impact and friction from razor-sharp oyster shells has not affected the 1/8" Dulon Cover on this BOSTRON belt. Says Mr. Frank M. Miles, President, "Our BOSTRON belt is good as new after 4 years operation . . . Exceeded every expectation!"

BOSTRON'S hazard-proof carcass, combined with Balanced Belt Construction, makes your investment in a superior Dulon Cover the most sensible, dollar-saving way to buy belts for your requirements.

An exclusive research milestone by

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Boston 3, Massachusetts

Please send free illustrated literature about the new hazard-proof BostRon Belts.

Company Name _____
Street _____
City _____ State _____
Attention _____

All five units in this stockpiling-reclaiming Barber-Greene belt conveyor system are shown here . . . the unloading conveyor . . . cantilevered radial stacker . . . two reclaiming conveyors . . . and the enclosed conveyor atop bunkers that fills bunkers automatically.

At new Steam Plant in Sarnia, Ontario:

AUTOMATED BARBER-GREENE STOCKPILE

One man controls Canada's highest-capacity steam plant coal handling system

Dow Chemical of Canada, Limited specified and got a stockpiling-reclaiming belt conveyor system as ultra modern as the rest of its new steam plant at Sarnia, Ontario.

Working as a team, Dow Chemical and Barber-Greene engineers designed an automated conveyer system that can stockpile 20,000 tons of coal in eight hours at 2,500 tph. The bunkering conveyor system reclaims, crushes, samples and weighs coal before delivering it to steam plant bunkers at 440 tph.

Self-unloading ships deliver coal to a special dock on St. Clair River and feed it at high speed into a 20′ x 20′ hopper. The hopper feeds a 60″ x 325′ belt conveyor that moves coal at 670 fpm to a cantilevered radial stacker. This special 110′ stacker with 60″ belt stockpiles in a 150° arc.

Material is reclaimed on a 170′ tunnel conveyor under the pile that feeds the crusher. Tramp iron is removed by a magnetic head pulley on the conveyor, and the coal is discharged into the crusher. A 319′ conveyor fed by the crusher moves the coal over an automatic weighing device to a 115′ tripper conveyor that automatically charges the bunkers.

Get the same very special attention for your bulk materials handling problems, no matter how complex or commonplace, by calling in your Barber-Greene Conveyor Representative.

Your belt conveyor equipment headquarters.

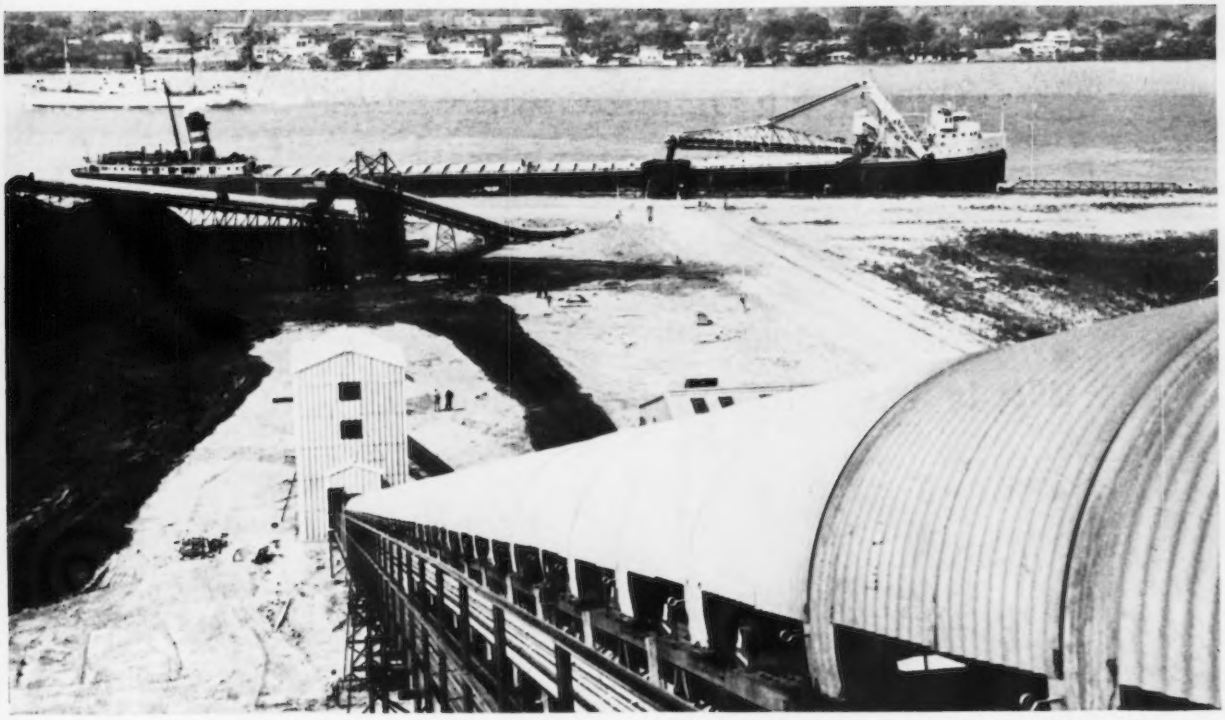
Representatives in Principal Cities of the World

Barber-Greene BG

Main Office and Plant AURORA, ILLINOIS, U. S. A.
Other Plants: DeKalb, Milwaukee, Detroit, Canada, England, Brazil, Australia

CONVEYORS • LOADERS • DITCHERS

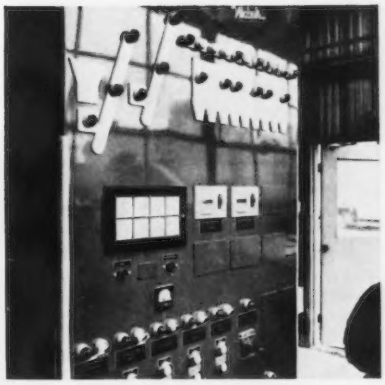
ASPHALT PAVING EQUIPMENT



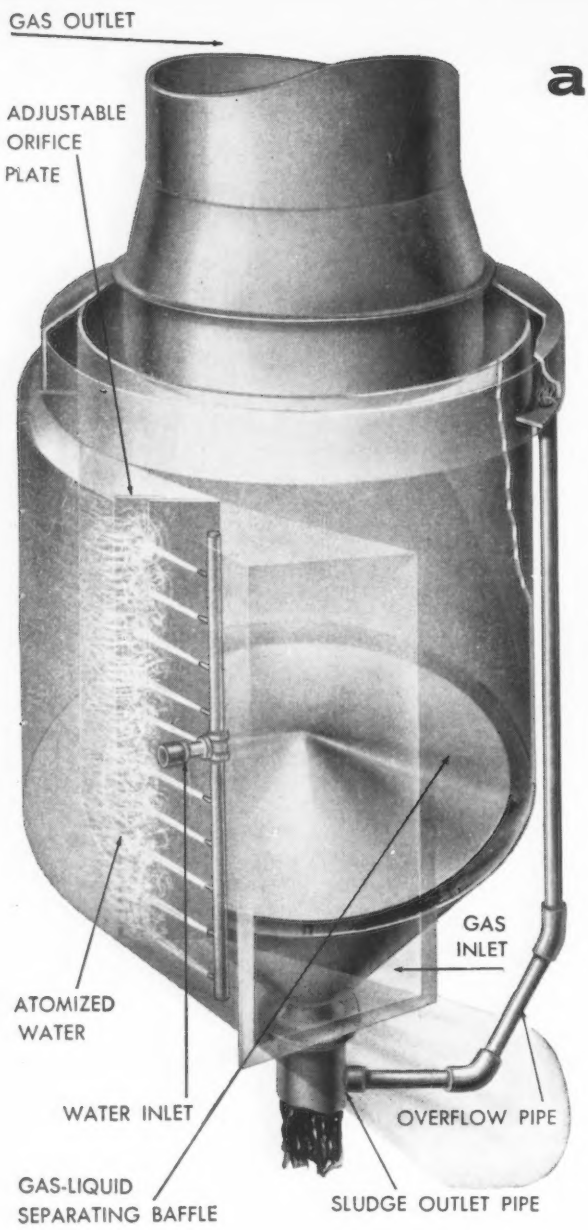
Huge coal ship spends minimum time at river bank dock because high-speed Barber-Greene stockpiling conveyors can transfer 20,000 tons of coal to stockpile in eight hours. Utilization of many control devices makes system both automatic and safe to operate.

BELT CONVEYORS COAL AT 2,500 T.P.H.

Specially-designed counterweighted radial stacker is supported only at tail end. By means of level indicator and timer, it automatically moves to new position each time coal reaches head of stacker. Both stacker and conveyor feeding it can be stopped from any point by operator. Conveyor system's 800-1,200 hour lube interval minimizes maintenance needs.



Entire operation is automatically controlled from two master control panels. Panel lights indicate operating status of all equipment in system.



a NEW scrubber for ultra-efficient dust and fume control

THE DUCON TYPE VO Oriclone® SCRUBBER

- 50% less space requirements than other high energy scrubbers.
- Higher operating efficiency at lower horsepower.
- Adjustable orifice maintains peak efficiency when operating conditions vary.
- Economical in first cost and operating cost.
- Simplicity of design permits economical alloy construction or acid brick lining.
- 99% efficiency below 2 micron and in sub-micron range.

The Ducon Type VO Oriclone Scrubber—the only high energy scrubber with an adjustable orifice—is the most effective and most economical dust and fume collector for a wide range of industrial applications, including recovery of catalyst dust, cupola dust and fumes, acid mists, tar fog and many others.

The Oriclone Scrubber is a completely integrated unit that performs the entire separation cycle. No subsequent collector is needed.

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CYCLONES • CENTRIFUGAL WASH COLLECTORS • TUBULAR CLOTH FILTERS • DUST VALVES

T-WEDGE KLEENSLOT

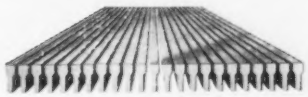
A new concept in guard bar design. T-shaped wire replaces typical "bar" to increase screening surface while keeping large unscreenable lumps of material above the tolerance governing lower screening surface.

F217 and F250
KLEENSLOT

Manufactured with large size wedge shaped wires to maintain maximum efficiency over an extended period in abrasive applications.

Although large in wire size, this screen will easily maintain openings as close as 1 m.m.

G187 and GB187
MIGH-TEE KLEENSLOT

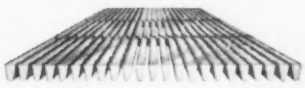


Special profile increases wearing surface. This is a heavy duty precision type screen that will easily maintain openings smaller than ⅛ m.m. and openings larger than ordinarily considered economical.

"S" KLEENSLOT

Engineered for applications where screening out of flats or slivers is of prime consideration. Can be also furnished in a "C" bend. Recommended for applications requiring openings larger than 1 m.m. For smaller openings, see Marcel screen.

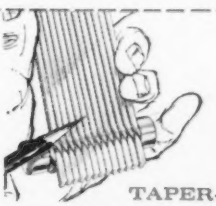
MARCEL



This screen, while screening out "slivers," presents a flat surface for materials to wipe the opening clean. Available with openings up to 1 m.m.—for larger openings see "S" screens.

SCREEN GUARD

Vertical guard bars keep larger unscreenable materials above the actual screening surface. This increases screen life and promotes much greater efficiency in dewatering.



TAPER-SLOT

From loop to loop, the screen opening gradually increases. This design is to eliminate blinding when screening large amounts of near-opening size materials.

For example: .016 opening tapered to .024—the combination of opening sizes would be the same between each loop throughout the entire screen.

WEDGE-WIRE

REG. U. S. PAT. OFF.

Kleenslot

PREPARATION SCREENS

designed for vibrators or stationary applications for dewatering, screening, washing, extracting, filtering or sizing applications.

Wedge-Wire Kleenslot Screens are custom manufactured to your application and are available in many sizes, metals and finishes. Our engineering staff will assist you capably and promptly in obtaining the proper screen for highest production at lowest cost.

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SCREENS FOR INDUSTRY

WEDGE-WIRE CORPORATION
Wellington, Ohio

send for our free catalog

24 Westinghouse Main Drive Motors and Control to Power Largest Mobile Land Machine Ever Built

14,500 Horsepower to Drive Bucyrus-Erie's New 14,000,000-Pound Giant Shovel for Peabody Coal Co.

Main drive d-c motors and M-G sets have exclusive Westinghouse Thermalastic® insulation, exceedingly stable and resilient, to withstand electrical thermal shock variations encountered in shovel service. Tough, low-inertia d-c motor armatures make possible very fast starts, stops and reversals.

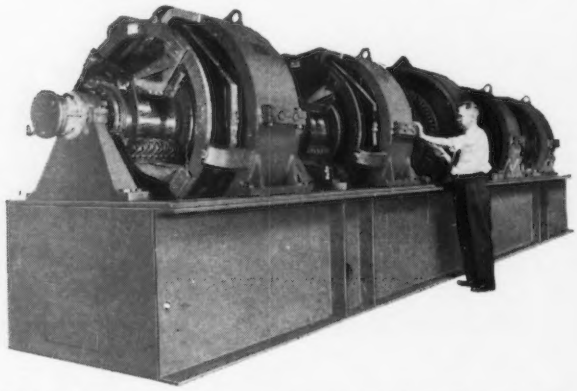
Westinghouse electrical equipment —powerful, fast and reliable—will drive this huge shovel. For digging there will be eight 625-hp d-c hoist motors, six 500-hp d-c swing motors, and two 500-hp d-c crowd motors. A separate d-c generator will power each motor. The generators will be assembled into four M-G sets, each driven by a 3000-hp synchronous motor. Eight 250-hp a-c motors will power the crawler propel drives. Dozens of smaller motors will power various auxiliary drives.

Modern Magamp-exciter control provides smooth performance and fast response of the main d-c drives with minimum current overshoot. Flexible and easily adjustable, this control permits selection of optimum motor performance characteristics needed for any particular digging condition.

With Westinghouse Magamp-exciter control for the hoist, swing and crowd, the huge machine will have a 50-second digging cycle. Loaded dipper speeds during swing will reach 25 miles an hour; the boom will accelerate to top speed in eight seconds and decelerate to zero speed in four seconds. Westinghouse drives will be built to maintain this demanding performance continuously, withstand extreme vibration and still develop over 200% of rated loading whenever required.

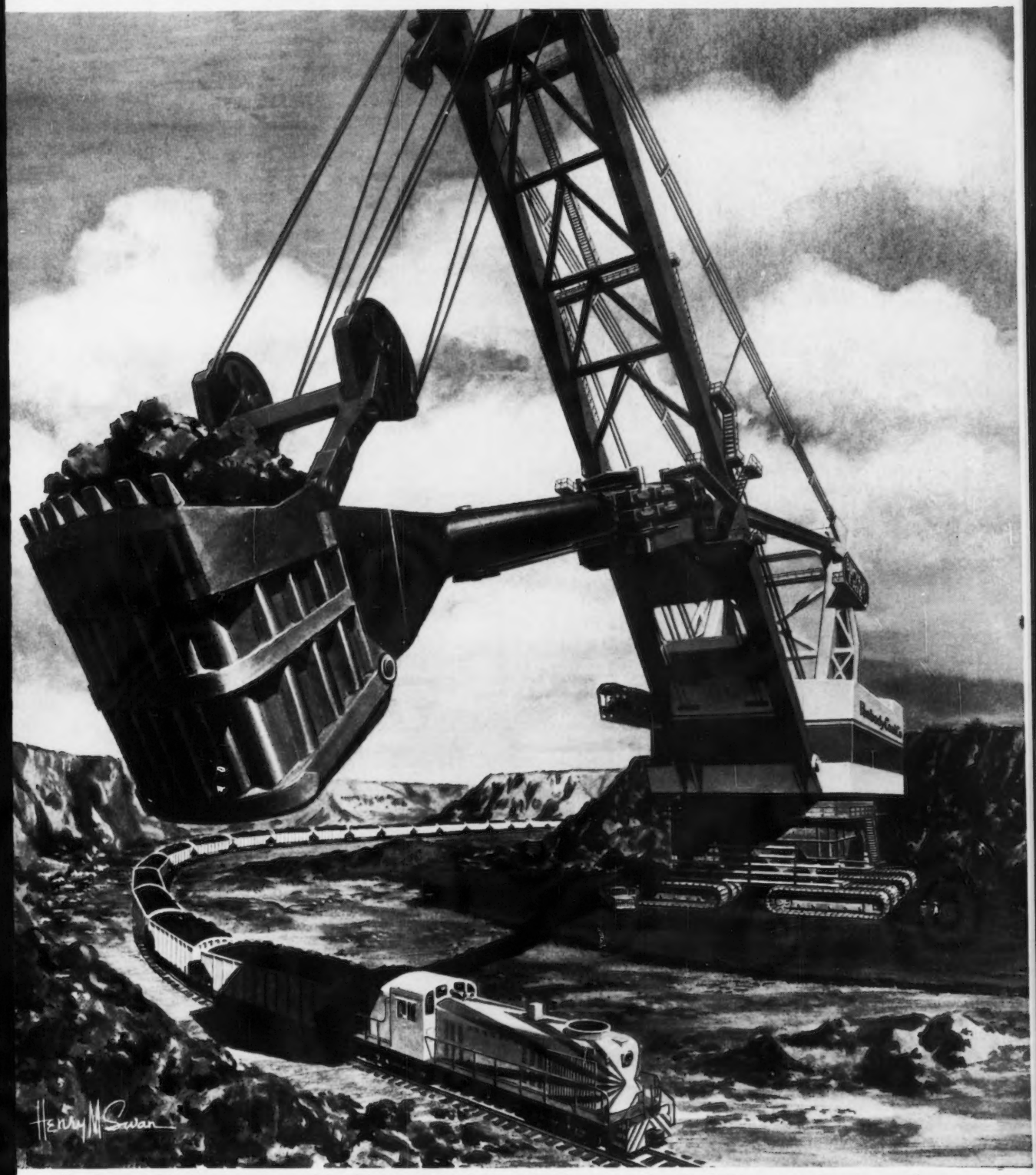
You can be sure...if it's Westinghouse

J-96159



World's largest shovel motor-generator sets have these design features—Heavy-duty, self-aligning, spherical seat pedestal sleeve-type main bearings and double-ball end thrust bearings —permitting operation at as much as 10° tilt. Extremely heavy and rigid self-supporting bedplate—insuring that rotating units will stay in correct alignment even under heavy shock stresses and vibration transmitted from shovel structure.

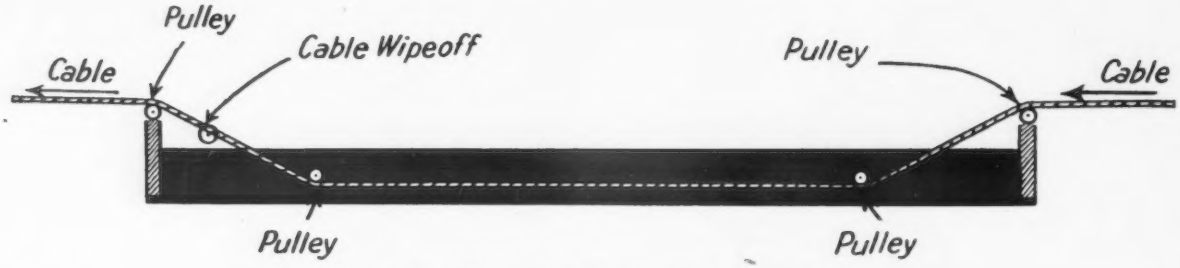
Westinghouse



New Bucyrus-Erie electrically driven strip mining shovel for Peabody Coal Company will weigh 7000 tons, more than Juneau Class Navy cruiser . . . will tower 213 feet high with 450 feet working range. Mammoth 115-cu-yd dipper is 64% larger than any built to date . . . will move over 200,000 tons of overburden per day, making possible mining of 4,000,000 tons of coal per year.

LUBE LOGIC

2 new ways to trim downtime



Warm bath restores wire rope

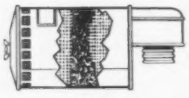
The best way to get lubricant inside a cable, where it's really needed, is to immerse the cable or wire rope every 500 hours or so in a bath of warmed-up Crater A lubricant. It pays off by giving you far longer service life than you would get simply by applying Crater A externally. This warm-bath treatment requires a horizontal trough to hold the lubricant. The trough should be fitted with pulleys to keep the cable completely submerged while it's passing through. A burlap collar should be rigged to wipe off excess lubricant as the cable leaves the box. An immersion of about a minute will allow the lubricant to work well into the strands.

This process is *not* an alternative to other lubrication. You should continue to clean the cable and apply Crater A externally every 10 to 100 hours, depending on the type of work the cable is doing. Remember also to be very sparing with lubricants on cables that wind on clutch-equipped drums, and never lubricate cables that are dragged in dirt.

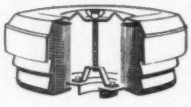
Key points on air filter maintenance

In a day's operation a typical engine inhales several thousand cubic feet of air, and in strip mining all that air is probably loaded with abrasive dirt and dust. Good air-filter maintenance is the only way to make sure your engine gets the air and not the dirt. Here are some maintenance tips that will keep your air filter working harder through thick and thin.

Oil-bath type air filters won't function properly if there's more than a half inch of sediment at the bottom of the oil reservoir. Check the sediment level by sticking a screw-driver down into the oil, and if you're anywhere near the half-inch level, the bowl should be cleaned out and refilled. Also, inspect the filter every 5 to 50 hours to make sure the oil itself is at the right level. Every 500 hours the whole cleaner should be dismantled and cleaned, and refilled with new engine oil of the same grade used in the crankcase.



Wire gauze type filter. If you want to re-use the element, wash the gauze in kerosine or diesel fuel, shake it dry (don't blow it with compressed air) and re-oil it with SAE 40 or 50 oil to coat the element.



Dry type air cleaners (the ones with the fluted paper element) should simply be shaken or tapped lightly to remove dirt, and reinstalled. Never clean dry-type elements with kerosine or diesel fuel.

Additional precautions: empty centrifugal precleaners when the glass container is half full; don't remove the oil cup when the engine is running.

TEXACO LUBRICATION ENGINEERS

Every month or so we'll bring you a batch of "sleepers"—little angles, so easy to overlook, where big savings in time and money can be made. But month in, month out, your local Texaco Man is your best source of money-saving lubrication ideas. Don't forget that "Lubrication is a major factor in cost control." Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

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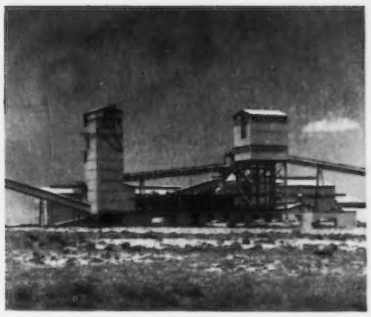


Ropes on Koepe Hoist Handle 2,400,000 Tons in Potash Mine in New Mexico

Serving for 26 months on a Koepe skip hoist at National Potash Company's mine, Carlsbad, New Mexico, Bethlehem Wire Rope handled approximately 2,400,000 tons of corrosive ore. The hoist cables were 1-in. 6 x 27 Form-Set Purple Strand, with fiber core; 1⅜-in. 19 x 19 Form-Set mild plow, non-rotating rope was used for the tail lines.

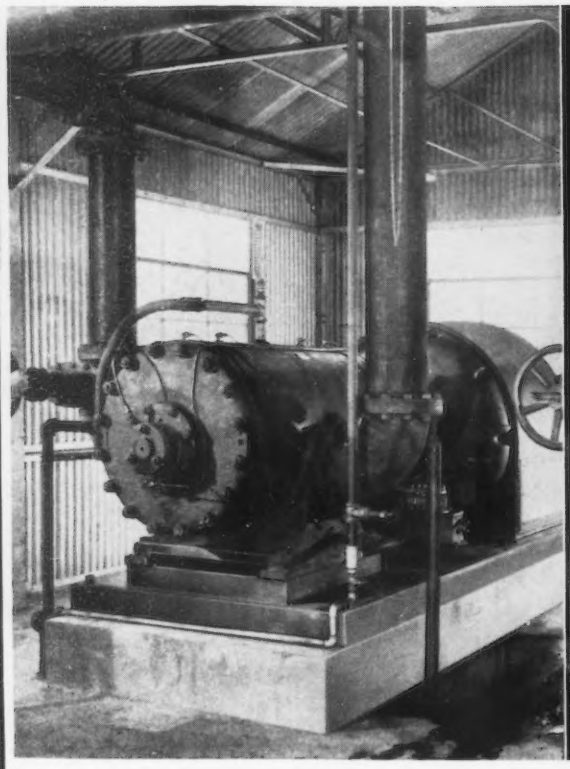
Economical service is something you can rely on when you specify Bethlehem Wire Rope. Put it to work and you can count on faithful rope performance, shift after shift.

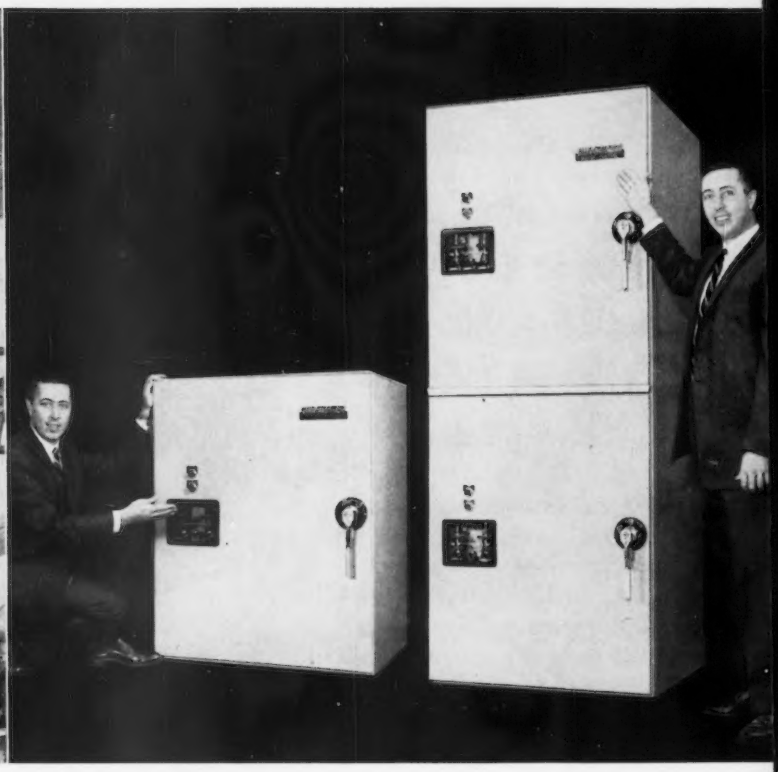
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

There's a distributor of Bethlehem Rope near you, supplied by our nationwide network of wire rope mill depots.

ideas and news:





Constant vacuum . . . year after year: Ro-Flo vacuum pumps with sliding-vane rotary design eliminate operating losses inherent in reciprocating machines. Centrifugal force keeps vanes in close contact with cylinder walls, automatically compensating for wear. In addition, few moving parts required, reduce wear, simplify maintenance.

So low, two fit where one used to go: This new SpaceMaker control center is the first completely new 2- to 5-kv motor controller development in more than a decade. New compact two-high design can cut floor space requirements in half. Complete drawout construction makes it the safest, most easily accessible controller on the market. New flame-retardent, track-resistant Super Pyro-Shield insulation adds to reliability, reduces size and weight. And, the all-new roll-out contactor has been designed specifically to cut maintenance time and costs.

Which of these productive ideas could be working for you?

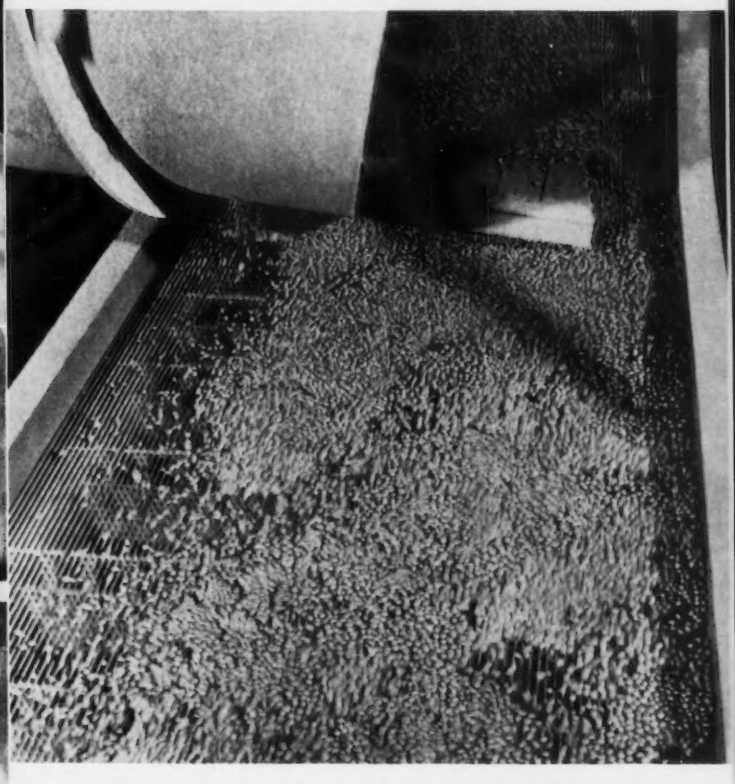
A system that makes low-grade ore valuable. New motor controls that save space. Where could your company apply these? What about all the rest of the idea-filled products which result from the A-C "usefulness" concept of design? Have an application? Call your A-C representative for information. Or write Allis-Chalmers, Industrial Equipment Division, 906 S. 70th St., Milwaukee 1, Wis.

Ro-Flo, Grate-Kiln, Superior, Hydroset, SpaceMaker and Pyro-Shield are Allis-Chalmers trademarks.

A-1403

From low-grade ore . . . ideal blast furnace feed: Now processing 1000 ltpd of beneficiated, finely powdered concentrates from low-grade iron ore, the new Grate-Kiln system produces these iron-rich pellets. Easy to ship and ready to use as blast furnace charge, these pellets are also economically produced. Costs are kept low by a unique system of heat recovery and process control.

Keeping pellets optimum sized: Installed as part of the first Grate-Kiln system used for iron ore processing, this specially-designed A-C vibrating screen "sizes" pellets from the Allis-Chalmers balling drum, permits only properly sized balls to pass to the system for heat processing. Years of experience in handling screening problems like this have resulted in a wide range of screen sizes and features.



Rugged primary gyratory crusher: This 60-inch Superior gyratory crusher crushes tons of hard, abrasive ores daily — proof of its tough construction. But, in addition, this machine requires no downtime for resetting to compensate for mantle and concave wear. The Hydroset control, exclusive with A-C cone and gyratory crushers, permits instantaneous wear — compensating adjustment while in operation.

A-C INDUSTRIAL EQUIPMENT DIVISION: motors, generators, controls, rectifiers, pumps, compressors, crushers, mills, screens, kilns, coolers, industrial systems.

OTHER A-C PRODUCTS: thermal, hydro and atomic electrical generating equipment; switchgear, transformers, unit substations; tractors, earth-moving equipment, engines, lift trucks.

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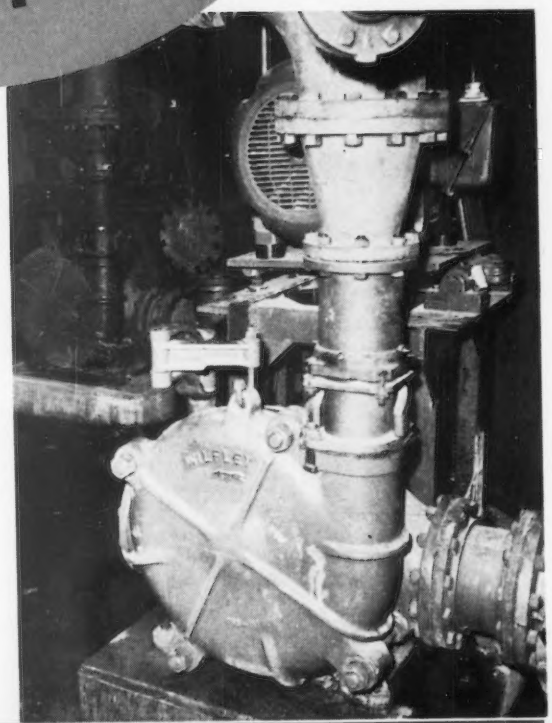

A. R. WILFLEY and SONS, INC.

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What Killed Ophir?

An Editorial

A LONE LEAKY HYDRANT in a weedfield high in a hanging valley in the Colorado Rockies can mean only one thing—you're looking at a ghost camp. Folks in the area say it's called Old Ophir. A few mine dumps on the sides of the mountains that rim the valley, a cluster of deserted cabins, the bleached skeleton of a saloon and a battered buckboard complete the scene. Talk about depressed areas? Here you have the No. 1 depressed area, with population zero.

There's something awesome, and yet something meaningful in this scene of desolate grandeur. Perhaps Ophir faded to extinction because of the price of silver plummeted, or because the miners ran out of ore.

These things were considered normal risks of mining. If a man struck it rich, he was permitted to keep most of his gains. And so, against great odds, the prospectors of yesterday continued to look for more Ophirs. But today a combination of industry lassitude, unsympathetic government attitudes on Federal and local levels, and misguided labor unions work collectively to create more Ophirs, and at an alarming rate.

Smelter men tell us that in mining areas such as Salt Lake City the number of ore shippers has dwindled from about 200 to about 20 to 30.

Now what are some of the Ophir-makers, and what can be done about them? Here are some suggestions:

1. The ill-advised and unnecessary gold-mine closing order L-208 of World War II shut down all domestic gold mines after virtually all able-bodied men had gone to the Armed Services. Damage was so severe that many of the mines never survived. A subsidy for domestically-mined gold could reverse this Ophir-making trend.

2. County and state governments, representing the majority voting power of farmers and businessmen, are loading mining ventures with unfair and excessive taxes. There can easily be Ophirs on the Mesabi Range if Minnesota doesn't reverse its tax policies soon.

3. Mines are wasting assets, and as such are entitled to special tax considerations. And yet both the Truman Administration and the current one regard depletion allowances as "tax loopholes." A little enlightenment here would help.

4. Labor leaders have contributed to Ophir-making on two counts: (A) They have failed to recognize the basic economic law that although the cost of producing a metal (say copper) may run from 15 to 30¢, all copper sells at virtually the same price. This completely rules out industry-wide bargaining, and demands that high-cost producers be given special concessions, otherwise they will go out of business—and many have! (B) The repeated annual demands for higher wages, first in steel, then in aluminum, and finally nonferrous metals resulted in inflated labor and material costs which have made it impossible for the small mine operator to compete with low-cost metal and foreign metal production.

5. Despite the alarming depletion of world silver supplies, expected to come to a head within 16 months, the Government is taking no action to stimulate domestic production. An upward adjustment of domestic silver prices, which is economically sound at this time, could reverse the present Ophir-making tide.

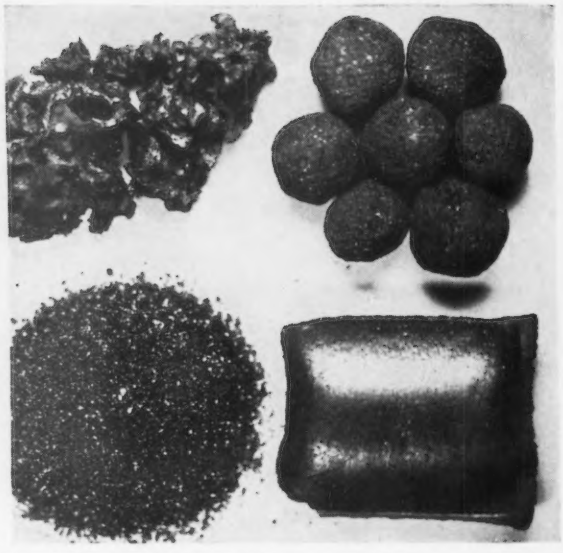
The foregoing comment does not imply that all domestic mining is on the skids, because, on the contrary, many new developments are underway. See E&MJ Census of new plants, January 1961. But the vanguard of mineral development, composed of prospectors and the small mine operators, is bucking discouraging odds.

The one single way that the entire mining industry including small and large operators, regional and national associations, and the mining press, can stop Ophir-making is to support Representative Baring's bill HR 2210 (see p 18).

This calls for the establishment of a Department of Mineral Resources with a Secretary of cabinet status who will look after the interests of the mining industry as effectively, for instance, as the present Secretary of Labor is working to improve the status of labor.

Blanket responsibilities of the present Department of Interior, with all the conflicting and opposed interests which it tries to represent, are obstructing mining progress. We need a man and a department in Washington with the sole responsibility of maintaining and promoting progress and welfare of the domestic industry.

CONCENTRATES ARE STOCKPILED next to railway line that connects remote Wabush Lake area with rest of world.



FOUR POSSIBLE FORMS of concentrates are seen here together: sinter, pellets, gravity concentrates, and briquets.

The Wabush Pilot Plant: Stepping

K. E. MERKLIN

F. D. DEVANEY

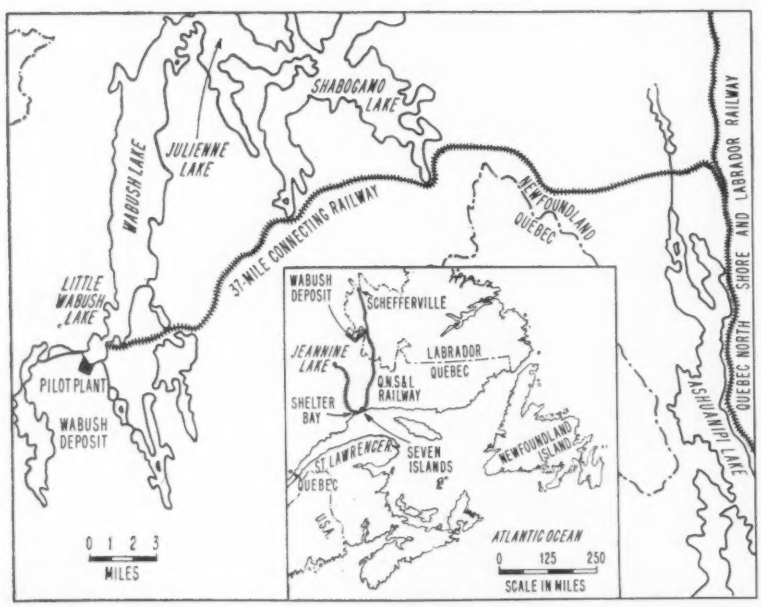
WHEN YOU DECIDE to invest about $200-million in a new large-scale iron-ore mining venture, you can do so only on a solid path built on the strongest possible evidence. Pickands Mather & Co., manager for Wabush Iron Co., Ltd., is establishing just such a path, for development of the Wabush Lake property in Labrador, Newfoundland, about 190 miles north of Seven Islands and near the Quebec-Labrador border.

Here in the heart of the remarkable "Labrador Trough," from a start under wilderness conditions, an extensive exploration-drilling and pilot-plant operation has been undertaken to prove the reserves and concentrating characteristics of the area's intermediate-grade iron ores.

The decision to invest in a well-built pilot plant has proved wise. Progress can now be made toward designing and building a large-scale installation, with confidence that the huge investment required will produce the predicted results.

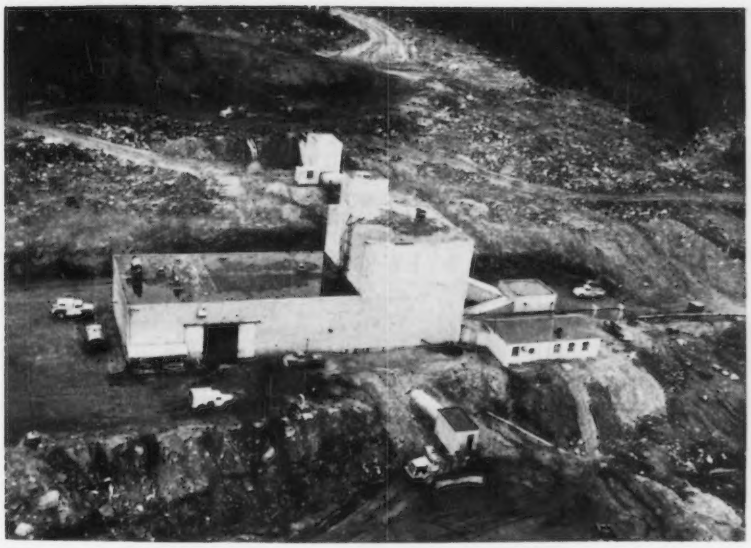
This article describes the pilot plant, which is one of the latest, most important items in the mining history of this remote, cold area. This history—discovery, development, drilling, etc.—will be described below.

The pilot plant was built at the south end of Wabush Lake (see map). The Wabush ore deposits, which lie to the south of the lake, occur in a formation which was originally a sedimentary deposit in the Labrador trough, but was subsequently metamorphosed so that a schistose texture developed. The orebody is essentially a rather friable itabirite, composed of medium-grained specularite, sugary granular quartz, rather earthy limonite or goethite, martite, and fine magnetite. Manganese occurs as soft pyrolusite, harder psilomelane, and more rarely manganite. Silicates, occasionally found, may be amphibole, pyroxene, garnet, mica, chlorite, and various clay minerals; in some places these may be considerably altered, in



PLANT SITE at south end of Wabush Lake is connected via 37-mi spur to Quebec North Shore & Labrador Ry. Wabush Iron Co.'s 5.6-sq-mi lease covers whole orebody.

Mr. Merklin is chief metallurgist, Hibbing laboratory, and Mr. DeVaney is director of metallurgy and research, Pickands Mather & Co.



ALL-WEATHER BUILDING, enclosing pilot plant, was completed in 1959. Over 40,000 tons of concentrates were produced and shipped in following summer and fall.

"DOWN-THE-HOLE" drill proved best for exploring soft iron-bearing formation.

Stone To $200-million Development

others they are fresh. Carbonates are also found in minor amounts.

This ore was drilled and tested over a period of three years. Result was a good general knowledge of the orebody and its beneficiating characteristics. But to arrive at specific refinements in the proposed flowsheet for a large-scale plant, a comprehensive pilot-plant study was proposed.

Pilot Plant Construction

A contract was let to a Canadian engineering firm to design a 30-ltph plant for year-round operation. This size was selected as suitable adequately to prove out equipment on a basis that could be confidently projected to 300-ltph mill sections. It could also supply large tonnages of concentrates for full-scale agglomeration and blast-furnace tests at steel mills of the Wabush participants—Steel Co. of Canada Ltd., Youngstown Sheet & Tube Co., Interlake Iron Corp., Inland Steel Co., Pittsburgh Steel Co., and Pickands Mather & Co.

Working with Pickands Mather's design metallurgists, the contractor promptly completed plans for the preliminary plant; and construction, in which PM's project supervisors cooperated, progressed rapidly. All buildings were enclosed late in 1959 before severe winter conditions set in. The logistic problems in building a facility of this type in this area can only be hinted at here. Fortunately, with difficult projects becoming more and more commonplace in this day of rapid technological progress, there are hardy men—pioneers all—who enjoy facing up to the difficult and making it seem easy.

MILL SUPERINTENDENT M. W. Tate is dressed for Wabush Lake winter.

Batch and small-scale pilot-plant tests had established the following general metallurgical features of the Wabush ore:

(1) It breaks readily to the natural grain size of the quartz and specular hematite. The magnetite grains are slightly harder to liberate, being somewhat finer.

(2) A high-grade product can be produced by simple gravity concentration at about minus-28-mesh.

(3) A very high-grade product can be produced from the magnetite portion of the ore by magnetic concentration after grinding to about 100 mesh.

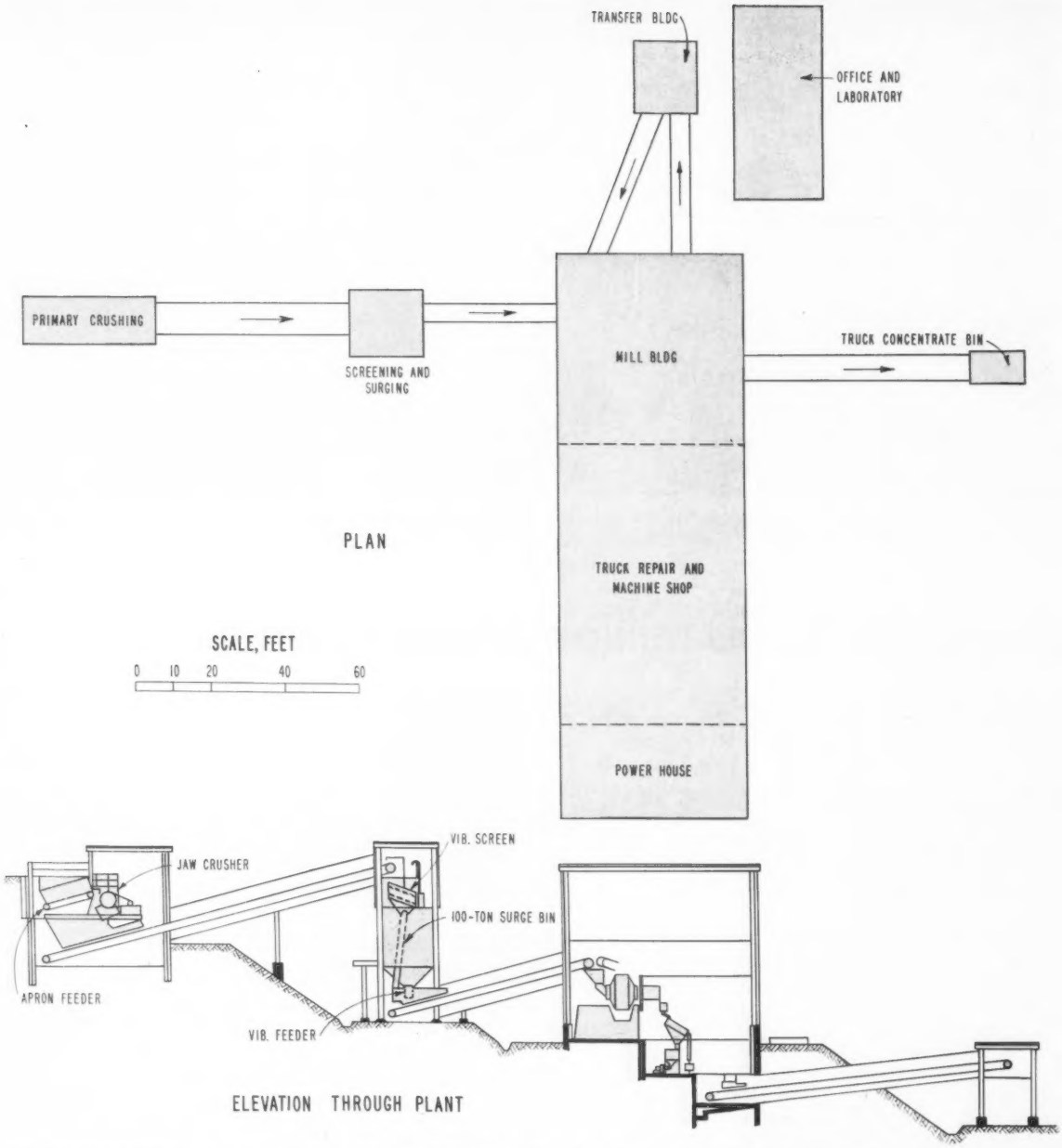
(4) Flotation can be used to lower the manganese content beyond the normal mining control if desired.

These four factors dominated the selection of preliminary plant flowsheets, with the following detailed considerations:

Grinding. The free-milling characteristics of the ore, with good liberation at a relatively coarse size, clearly made autogenous grinding a logical choice. Small-scale pilot plant tests showed that wet autogenous grinding offered some operating advantages over the more complex features of the dry system. There was some concern, though, about problems that could be encountered in wet-sizing the ore at 28 mesh. The mineral dresser will recognize this as a size range that is coarse enough to be hard to handle efficiently with hydraulic classification methods, yet fine enough to be demanding of a mechanical screening plant. The dry system with air classifying equipment did a satisfactory job of sizing in pilot-plant tests.

Final decision on grinding was left to the preliminary plant by installing an autogenous mill with auxiliary equipment suitable for either wet or dry operation. Mill size was projected from pilot-plant studies in the laboratory. Result was selection of a 10- x 4-ft unit equipped with a 100-hp motor.

Dry sizing. Sizing in the dry grind-



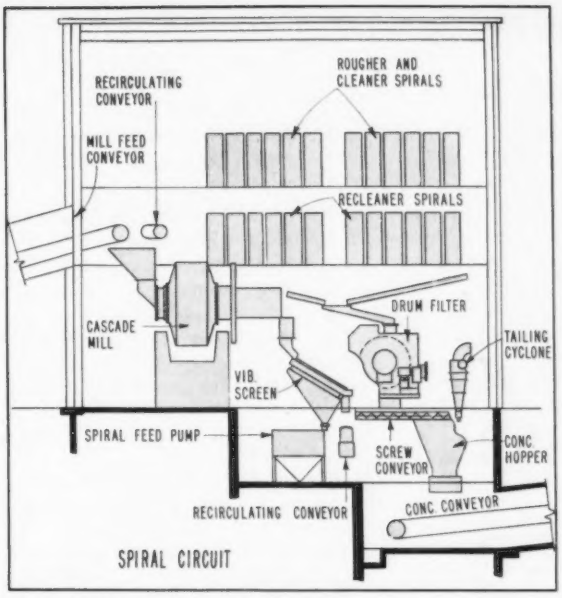
COMPACT LAYOUT, straight-through materials flow, are pilot-plant features. Compare drawings here with aerial view on p 85.

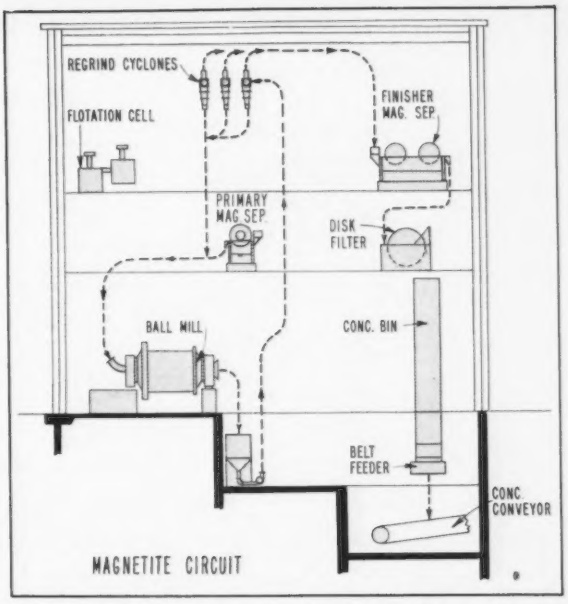
ing system is accomplished with three stages of air classification. The first consists of a simple expansion in cross-sectional area of the discharge duct from the mill, which results in the coarser particles' dropping out and back into the mill. Slightly finer particles are carried higher in the duct and discharged through a separate opening to an air cyclone, which removes most of the remaining ore as underflow. Final stage of classification is a wet dust collector, insuring a clean air discharge to atmosphere.

Satisfactory dry classification depends on having a low-moisture-content feed to the system. This is accomplished by preheating the intake air to the system to reduce the moisture in the ore to below 1½%. The grinding unit gives excellent gas-solids contact, resulting in efficient heat utilization.

Wet sizing. A number of devices were tried on a small scale, in an effort to uncover a suitable wet-sizing device for this application. Various mechanical classifiers, hydraulic sizers, and cyclones were tried, without arriving at a satisfactory solution. Mechanical screens offered the greatest promise, provided the capacity could be maintained at reasonably high levels and blinding did not become a problem. A decision was reached to try three types of screens in the preliminary plant. Two are high-speed, 3600-rpm, mechanical units; the third is a DSM stationary scalper. Screen oversize is closed-circuited with the autogenous mill, using conveyors.

Spiral circuit. The simplest concentrating circuit developed in the pilot-





SECTIONS through plant building show arrangement of major equipment in both spiral and magnetic sections. Magnetic circuit was included in pilot plant to gather data for future reference, even though first full-scale plant probably won't use it.

plant work consists of two stages of Humphreys spirals, roughers and cleaners, with cleaner tailings recirculated to rougher feed. Some possibilities for improved metallurgy seemed to lie with a three-stage spiral circuit, using two stages of cleaning. Provisions were made to try both flowsheets in the preliminary plant.

Magnetic circuit. Nearly one-fifth of the orebody at Wabush is in the form of magnetite. This, when liberated at about 100 mesh, is of excellent grade and has a physical structure suitable for producing high-quality iron-ore agglomerates. At present, the higher capital cost of an installation with a duplex flowsheet, having both spirals and magnetic separators, with regrind of the magnetics, does not seem to be within the scope of the initial large-scale plant. But, the potential possibilities made it seem worthwhile to include such equipment in the preliminary plant, so that detailed data could be collected for future reference.

The flowsheet selected consists of removing the magnetite ahead of the spirals, and regrinding it to about 100 mesh in closed circuit with cyclones. Cyclone overflow is passed over a finishing stage of magnetic separators, to produce a high-grade magnetite product. Tailings from both stages of magnetic separators are then fed to the spirals.

Scavenging circuits. While the Humphreys spirals gave good metallurgical results on sizes down to about 150-200 mesh, they are notably weak in recovering finer ore. Three types of scavenger circuit have been included in the preliminary plant, to try to recover more of this fine iron. A three-deck gravity concentrating table of standard commercial size, scavenger spirals, and scavenger magnetic separators—all offer possibilities.

Laboratory work has shown that the best scavenger approach is to size the regular spiral tailings at about 100 mesh in cyclones, thicken the cyclone overflow, and retreat this thickened product in one of the scavenger systems. This procedure reduces the tonnage to be treated in the scavenger circuit, while at the same time eliminating much of the coarse middling material, which would require excessive regrinding to make a satisfactory grade.

Table I—Structure of Preliminary Plant Samples

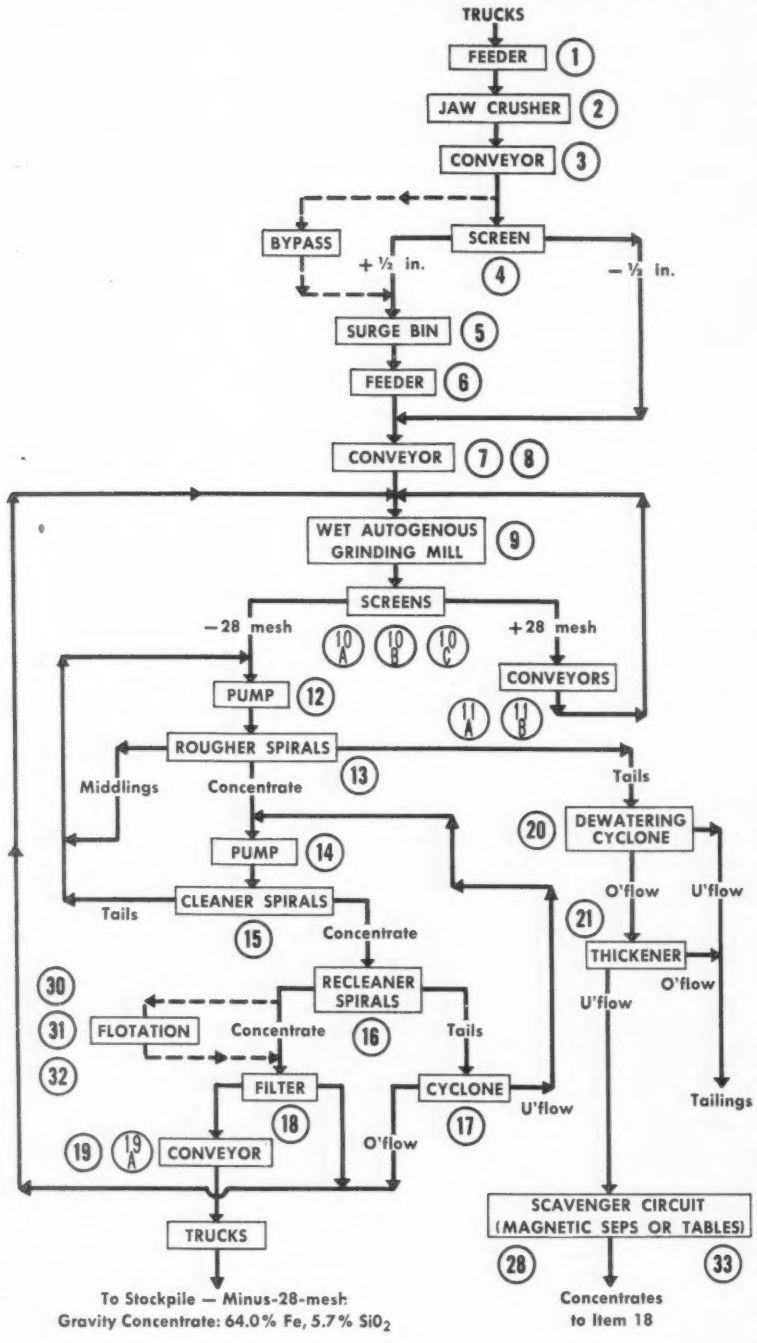
Size	Wt %: Autogenous Mill Feed	Wt %: Mill Screen Undersize	Wt %: Gravity Concentrate
+ 4 in.	13.30		
− 4 in.			
+ 1 in.	22.46		
− 1 in.			
+ 6 mesh	21.17		
+ 10 mesh	3.57		
+ 20 mesh	3.45	0.27	0.09
+ 28 mesh	1.93	4.12	3.29
+ 35 mesh	2.87	10.59	8.83
+ 48 mesh	5.03	17.83	15.49
+ 65 mesh	6.41	19.50	20.23
+100 mesh	6.90	17.77	22.49
+150 mesh	4.64	11.02	14.82
+200 mesh	2.54	5.75	7.51
+325 mesh	4.70	5.53	5.54
−325 mesh	1.03	7.62	1.71
Total	100.00	100.00	100.00
Wt %	100.00	100.00	44.00
Fe	38.00	38.00	64.00
SiO_2	—	—	5.5

Flotation. Because there are limonite and other earthy materials in the crude, which generate considerable slimes, flotation has not proved an acceptable primary concentrating process for the Wabush ores. But it does offer possibilities for control of manganese in the gravity concentrates if desired. The clean specular hematite grains can be readily floated away from manganese-rich minerals, resulting in two products: one high in iron and low in manganese; the other lower in iron and high in manganese.

The flotation circuit in the preliminary plant is composed of a high-speed conditioner, two 36-in. rougher cells, and two 36-in. cleaners. Cleaner tailings are recirculated to rougher feed by means of a pumper cell.

Filtering. Because the concentrates will probably have to be rail-shipped the year round to the port of Sept Iles, Que., they must have low moisture. Fortunately, these concentrates dewater quite readily, by filtering, to about 4% moisture. Because of their relatively coarse structure and high specific gravity, they cannot be picked

Flowsheet 1—Spiral Circuit



LEGEND

SPIRAL CIRCUIT

1. 36-in. x 12-ft Pioneer apron feeder
2. 20-in. x 30-in. Pioneer jaw crusher
3. 30-in. conveyor
4. 4-ft x 8-ft Tyler double-deck screen
5. 100-ton-capacity surge bin
6. 36-in. x 72-in. Syntron vibrating feeder
7. 30-in. conveyor
8. 30-in. Transweight belt scale
9. 10-ft x 4-ft Hardinge cascade mill (wet or dry) with 100-hp motor

10A. 3-ft x 7-ft Hewitt-Robins vibrating screen

10B. 3-ft x 7-ft Derrick Mfg. Co. vibrating screen

10C. 1-ft Door-Oliver-Long DSM screen

11A. 18-in. screen-oversize recirculating conveyor

11B. 18-in. screen-oversize recirculating conveyor

12. 6-in. x 6-in. Allis-Chalmers SRL rougher-spiral feed-pump
13. Twenty-four 5-turn Humphreys rougher spirals
14. 5-in. x 5-in. Allis-Chalmers SRL cleaner-spiral feed-pump
15. Twenty-four 5-turn Humphreys cleaner spirals
16. Twenty-four 5-turn Humphreys re-cleaner spirals
17. 24-in.-dia Dorr-Oliver-Long dewatering cyclone
18. 6-ft-dia x 3-ft Eimco filter-drier
19. 18-in. concentrate conveyor

19A. 18-in. Transweight belt scale

20. 24-in.-dia Dorr-Oliver-Long dewatering cyclone
21. 10-ft x 8-ft Dorr-Oliver-Long tailings thickener

FLOTATION CIRCUIT

30. 36-in. Wemco Fagergren high-intensity conditioner
31. Two 36-in. x 27-in. Wemco Fagergren rougher cells
32. Two 36-in. x 27-in. Wemco Fagergren cleaner cells

GRAVITY SCAVENGER CIRCUIT

33. 6-ft x 14-ft triple-deck Deister concentrating table

up on a leaf or bottom-feed drum; but internal drum, horizontal types or top-feed filters will do a very satisfactory job.

The machine selected for the preliminary plant is a 3-ft-wide by 6-ft-dia top-feed filter-drier. This unit differs from the normal top-feed filter in that air can be preheated before being drawn through the filter cake; in this way, additional moisture can be removed by drying, if desired.

A separate 3-ft single-disk filter was provided for dewatering the fine concentrate, when the magnetite is being run. This permits separate sampling, weighing, and handling of the two concentrates.

Preliminary Plant Operation

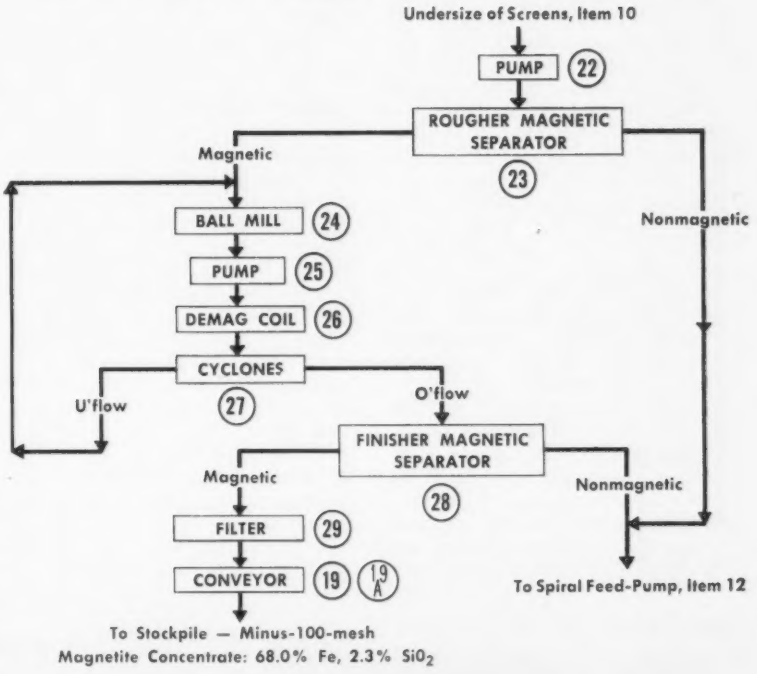
The plant was placed in operation in the last week of February 1960, following what most mill men will recognize as the standard procedure of starting a new plant under the most adverse weather conditions possible. The difficulties encountered, however, were pleasingly few. It was soon possible to start collecting pertinent data on the dry grinding system and three-stage spiral concentrating flowsheet.

Occasional high moisture content of the feed, due to snow and past accumulations of freezing rain in previously stockpiled crude ore, limited

Flowsheet 2—Optional Magnetic Separator Circuit

MAGNETITE REGRIND CIRCUIT

22. 5-in. x 5-in. Allis-Chalmers SRL pump
23. 30-in. x 36-in. Dings rougher magnetic separator
24. 5-ft x 7-ft Marcy ball mill
25. 4-in. x 4-in. Allis-Chalmers SRL cyclone feed pump
26. 3-in. Dings demagnetizing coil
27. Three 6-in. Dorr-Oliver-Long regrind cyclones
28. 30-in. x 36-in. Dings double-drum finishing magnetic separator
29. 4-ft-dia single-disk Dorr-Oliver-Long filter

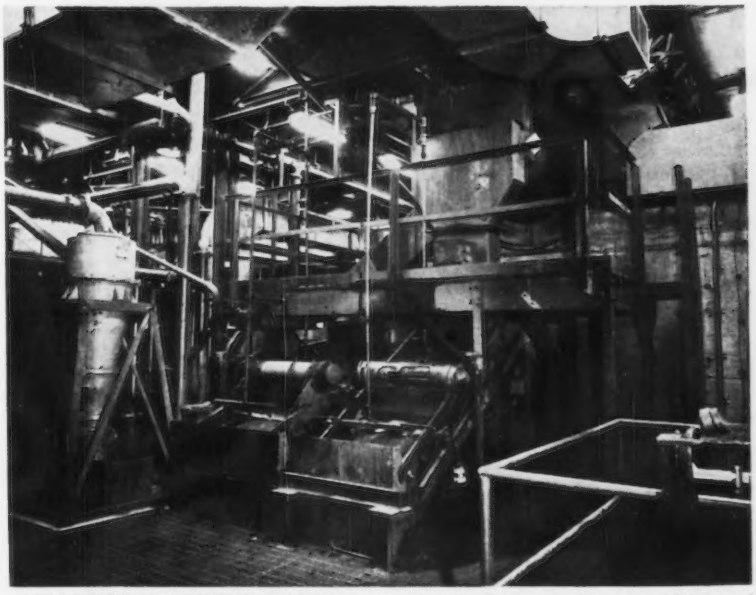


the operation of the dry grinding system. The spirals performed well; however they could not be pushed to capacity because of the grinding tonnage restrictions. Therefore, it was decided after about three weeks' operation that wet grinding should be tried; and the necessary circuit changes were quickly made. The fears about screening at 28 mesh proved to be unfounded, largely because of the small percentage of near-sized material in the feed. The generally simpler wet circuit was soon outperforming the more complicated dry system.

Subsequent months of operation have given substantial evidence favoring wet over dry autogenous grinding of Wabush ore. Grinding power consumption has been very low, averaging about 2.4 kwh per gross ton of minus-8-in. crude ore. This indicates the weakly bonded nature of the grains. Table I (p 87) shows a typical screen analysis of autogenous mill feed, screen undersize following grinding, and concentrates.

Test runs with two and three stages of spirals have shown that the latter produce a slightly higher grade at the same weight-recovery. But the most impressive observation is the consistency of the product grade that either spiral flowsheet will produce, in spite of occasional wide fluctuations in feed grade.

The top-feed filter has proven to be an effective method of dewatering spiral concentrates. Feed to the filter is about 55% solids. Normal moisture content of the filter cake is between 3.5 and 4%, and if desired, use of the filter-drier system can readily reduce it to 1½%. Recent studies have shown that the material ships best with a moisture content of about 4%, and that in this condition, freezing in stockpile or cars will be minor. If some skin-freezing in cars should occur, it can probably be taken care of by an infrared thawing shed at dumping point.



AUTOGENOUS GRINDING MILL (upper level) discharges into two high-speed vibrating wet screens; at left is tailings cyclone. Note how compactly equipment is fitted into mill building.

Tests with the shaking table have indicated that this equipment can produce a small increase in recovery from the fine tailing. Scavenger spirals have not proved as effective as tables. Magnetic separators have proved to be effective in recovering additional iron when the crude contains a fair percentage of magnetite. All three of these scavenger systems produce a good grade of concentrate; however, the economics may prove to be borderline, because of low-weight-recovery, averaging 1½-2½% of the crude.

Operation of the flotation circuit to control manganese has been very satisfactory. By control of amount of collector used (oleic acid), grade of

float product can be reduced to 0.20% Mn or below if need be.

Over 40,000 tons of Wabush concentrates were shipped to steel mills for sintering and blast-furnace tests in summer and fall of 1960. The material handled extremely well in rail transit, showing no dusting or spillage problems. Flow through bins and over transfer points was trouble-free; ship loading, movement, and unloading were normal. Steel-mill tests proved the concentrates to be very satisfactory, both in sintering and in the blast furnace.

At this writing the Wabush plant is continuing operation, with work yet to be completed on magnetic circuit, scavenger systems, and some minor design information requirements. The future promises even further important developments in the concentration of Wabush ores. The nature of this material is such that it may well prove feasible at some future date to consider production of ultra-high-grade concentrates for possible use in direct-reduction processes.

First Ore Discovered in 1933

The history of the Wabush Lake district, which has such a promising future, began almost three decades ago, when S. E. Gill, reporting his findings incidental to a search for gold in 1933, disclosed the first discovery of iron-bearing formations there.

The low-grade materials he discovered were of little interest to iron-ore producers in those days of direct-shipping ores from the "famous, inexhaustible Mesabi." But the increasing demand for products made from steel, and the tanks, guns and planes of World War II, left the Mesabi a shrunken remnant of its former greatness. As its miners turned to leaner concentrating ores for continued sustenance, the economic outlook for deposits in areas further away from the heart of North America's steel industry grew brighter.

When Iron Ore Co. of Canada was formed in 1949 to exploit the ore deposits of the Knob Lake area, 100 miles north of Wabush, the opening wedge was driven into this land of "nine months of winter and three months of tough sledding." When the Quebec North Shore & Labrador Railway was built, passing some 30 miles east of Wabush Lake, the remoteness of the area became nowhere near as forbidding.

In 1954 and 1955 Canadian Javelin Ltd. obtained from Newfoundland and Labrador Corp. Ltd., then representing the Newfoundland government, rights to explore and develop mineral resources in concessions in Labrador totaling over 4700 sq mi. Javelin directed immediate interest toward the intermediate-grade iron ore deposits lying to the south of Wabush Lake. Diamond-drill and test-pit samples were submitted to a number of different organizations for studies of concentrating characteristics.

Pickands Mather became interested in the Wabush area in 1956, as a possible source of high-grade iron-ore concentrates. The search was for material that could meet present blast-furnace standards for quality, such as the pellets produced by Erie Mining Co., a PM operation in Minnesota, and by Hilton Mines near Ottawa, in which it has an interest.

Wabush Iron Co. concluded agreements with Canadian Javelin that leased to Wabush an area of 5.6 sq mi. covering the entire Wabush Lake orebody.

At the same time as the leasing, Wabush started an exploration drilling program, and during the next year completed some 13,000 ft of diamond drilling. Problems with core recovery, and slow drilling rates in the soft, granular ore, made it desirable to find a better drilling procedure. Experiments with a "down-the-hole" drill showed superior results in both areas, though with some minor disadvantages due to the more finely divided state of the sample, occasional oil-contamination, and depth limitations. An extra 20,000 ft of down-the-hole drilling followed the diamond-drilling program. Geological composites, not exceeding 40 ft, were made and subjected to individual laboratory study. Iron and manganese assays were obtained on the crude, followed by magnetic tube and table tests, to determine the percent magnetics and gravity-concentrating characteristics of the samples.

The iron-bearing formation, because of lithologic similarities, is correlated by most geologists with the Sokoman formation, which is the unmetamorphosed iron formation at Knob Lake. Recent glaciation has covered the ore with deposits of drift that vary in depth from a few to several hundred feet.

Steep Theodolite Sightings Made Easy

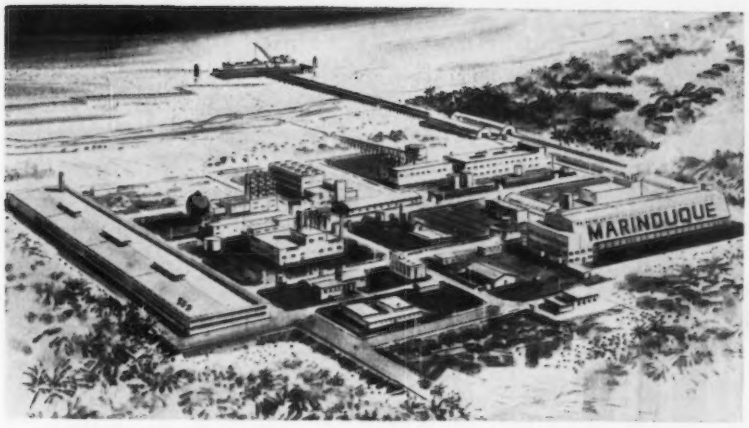
FOR SURVEYING that requires steep sightings, the Swedish theodolite-maker Kern has made an auxiliary telescope that attaches semipermanently to the main telescope of their DKM 1, DK 1, and DKM 2 theodolites. The auxiliary scope was developed at the suggestion of Kauno Kangas, chief mine surveyor of Luossavaara-Kiirunavaara AB, Malmberget.

Unlike many older auxiliary telescopes, it does not have to be remounted for each setup. It is always ready for use, remains permanently steady on the theodolite, and yet does not interfere with normal surveying through the main telescope. It weighs only 3 oz; and because of its small size, it fits, mounted, into the standard carrying case and can be reversed together with the main telescope, for plunging. The rotating eyepiece and eyepiece prism attachment let the operator sight through the instrument from a comfortable position, even in narrow and difficult openings. Luossavaara-Kiirunavaara has used the scope successfully since 1954.

Vertical sightings, either up or down, can be made. The optical axes of main and auxiliary telescopes are parallel and vertically above one another. When the auxiliary scope is mounted with a good metal glue on the contact surface, and the space between the scopes is filled with a non-shrinking hardening plastic material, the instrument can stand rough handling without going out of adjustment.

ARROWS point to upper & lower ends of auxiliary telescope. Eyepiece (upper arrow) can be rotated through 180°, and can have prism attached for sighting from above.

With the axes 45 mm apart, a correction of $\frac{8.454^\circ}{f}$ (f = distance, ft) must be added to auxiliary-scope readings.



AT NEW reduction-fabricating plant chemical treatment will produce copper.

Philippines To Get Unique Copper Plant

ANNOUNCEMENT was made on Jan. 31 of a planned new copper-producing plant in the Philippines that will be built by American contractors. It will have several "firsts" and "onlys" rolled into one.

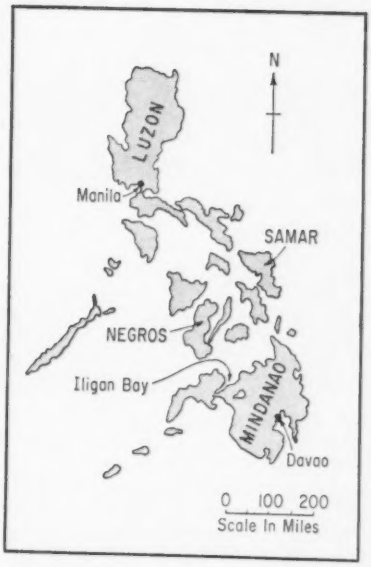
For one thing, it's believed to be the world's first plant to produce copper metal commercially through low-temperature chemical means, rather than by smelting. For another, it may be unique in being a fully integrated reduction-fabricating works, which will take in concentrates and turn out wire, tubing, strip, and sheet.

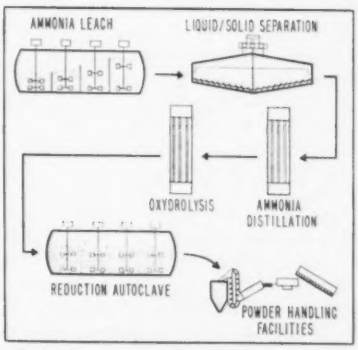
It will be a first for the Philippines too—first copper reduction or fabricating works in the republic. Its capacity, 14,000 tpy of copper and copper products, will meet the country's entire present need for the metal. Also, it will make 100,000 tpy of an important by-product, ammonium sulphate fertilizer, important to the agricultural Philippines; and it will produce 5000 tpy of by-product zinc.

The new works will be built at Iligan Bay, on the southern Philippine island of Mindanao. Marinduque Iron Mines Agents Inc., a growing, diversified Philippine mining company, will own and operate it. Several North American companies will be involved in the construction. Reportedly the new plant will be identical in most respects to the Sherritt Gordon chemical refinery at Fort Saskatchewan, Alta., which produces pure nickel powder, as well as cobalt and ammonium sulphate, from Lynn Lake, Man., sulphide concentrates. Its flowsheet was published in E&MJ, mid-June 1958.

Reduction stage of the new plant's process is based on high-pressure ammonia leaching and hydrogen reduction, and will produce a high-purity copper powder. Second stage, that of fabrication, consists of pressing and rolling the powder into strip, and then of further rolling it into desired finished shapes.

Equipment for forming strip from powder was developed and patented by the E. W. Bliss Co., one of the North American companies involved in the Marinduque project. Other companies





STAGES of high-pressure ammonia leach-hydrogen reduction process.

involved will be Foster Wheeler Corp., prime contractor, which will be responsible for engineering and construction; Chemetals Corp., which controls rights to many patents affecting the chemical process; and Sherritt Gordon Mines Ltd., which granted these rights to Chemetals for processes involving copper but retained them for those involving nickel and cobalt.

A $13-million loan from the Export-Import Bank of Washington, a U.S. Government agency, was the key to Marinduque's going ahead with the planned plant. Granting of the loan was announced Jan. 31. Marinduque will match the funds in pesos, to pay for the $23-million plant.

The following claims are made for the two processes. Ton-for-ton, the chemical process for making copper powder from concentrates will cost 40% less to build than a conventional complex of smelter, refinery, and casting plant. Facilities to make strip and tubing from copper powder will cost 50% less than conventional fabricating facilities starting from cake, ingot or billets.

Reasons why Jesus S. Cabarrus, president of Marinduque, and his associates chose the low-temperature chemical-powder process were given as follows:

(1) A conventional copper smelter and electrolytic refinery is not economic on the tonnages Marinduque wants to treat —about 42½ tpd of copper. The Chemetals process is said to be very efficient in this range.

(2) Much of Marinduque's concentrates are zinc-rich. These are amenable to leaching but are not desirable for conventional treatment.

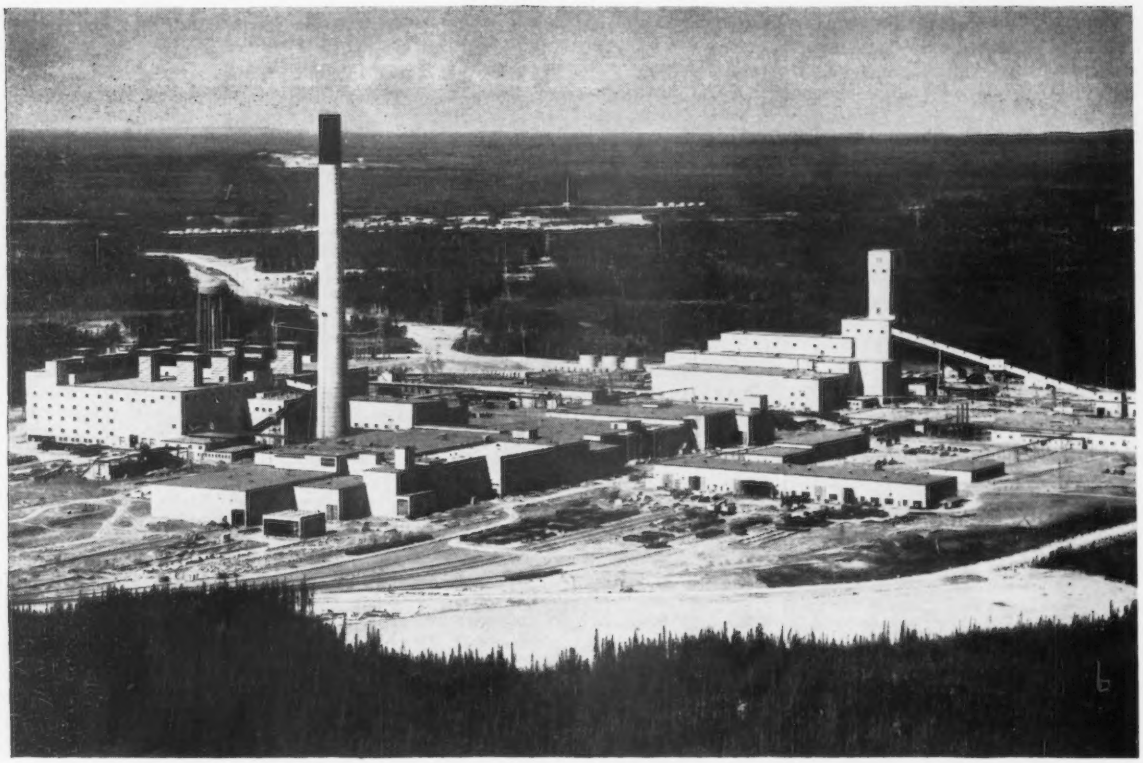
(3) The ammonium sulphate by-product, produced very cheaply and utilizing about 80% of the sulphur in the concentrates, is greatly needed in the Philippines for fertilizer.

(4) The Bliss fabricating techniques enable a prime copper producer to make wire, tubing and strip with a capital investment considerably below that of conventional fabricators.

Marinduque now produces 75,000 tpy of copper concentrates, most of which are sold to Japan. Its Sipalay property, on the island of Negros, produces 35,000 tpy of 25% copper concentrates by conventional mining and concentrating methods. The Bagacay property, on Samar, produces 40,000 tpy of a copper-zinc concentrate, which contains too much zinc to be a desirable feed for a conventional copper smelter. Marinduque also exports iron ore and molybdenum.

The Marinduque concentrates have been tested by Chemetals and Sherritt Gordon for 18 months; reportedly they have proved amenable to the high-pressure ammonia leach-hydrogen reduction process. Between now and actual Philippine construction, the two companies plan to run substantial-tonnage-scale tests on the concentrates, with selected Marinduque personnel taking part.

The output of the integrated copper-zinc-ammonium-sulphate facility is expected to yield for Marinduque an equivalent annual volume of $18.5-million, at current U.S. prices. It would result, too, in a net annual saving in foreign exchange of $10-million or more for the Philippine economy. The Export-Import Bank's credit of $13-million is repayable in 10 years commencing in 1964, when the plant is expected to be in operation.



NICKEL PRODUCTION at the new Thompson project in Manitoba will soon reach an annual rate of 75-million lb. Of the initial $185-million expenditure required for the project International Nickel Co. of Canada ventured $130-million.

Inco Dedicates Thompson Nickel Project

DEDICATION CEREMONIES for International Nickel Company of Canada's $185-million nickel project at Thompson, Manitoba, were held on March 25. Representatives of the Canadian Government, United States and United Kingdom governments, and leaders of business and industry from the three countries attended the ceremony. The Honorable Duff Roblin, Premier of Manitoba, was scheduled to officiate at the dedication ceremonies.

The Thompson nickel development in northern Manitoba is the first fully-integrated plant for the production of refined nickel, and is exceeded in capacity only by Inco's operations in Ontario. Decision to undertake commercial production of nickel at Thompson was made a little more than four years ago. Commercial production is expected to reach an annual rate of at least 75-million lb in the near future.

A 10-Year Search

Inco's search for new nickel deposits in Manitoba dates back to 1946. Year after year geologists and geophysicists searched the area. But significant progress was made only after the development of airborne electromagnetic devices (EM equipment) which, with the airborne magnetometer, gave the exploration crews a fast and effective tool to find nickel orebodies. The Moak Lake orebodies were discovered after ten years of intense exploration involving 56,000 linear miles of airborne survey. Hundreds of thousands of feet of diamond drilling ran the total exploration cost up to $10-million before the mining project was even started.

Ore Is Low in Copper

Thompson deposits contain nickel sulphide ores similar to those mined in the Sudbury District. However Thompson ores differ from Sudbury deposits in that they contain small quantities of copper, while Sudbury ores are relatively high in copper. Minor amounts of cobalt, platinum, palladium, gold and silver are also present in Thompson ores.

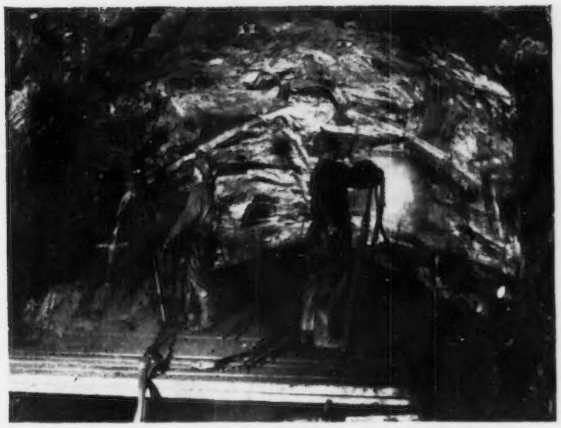
Cut-and-Fill Mining

The production shaft at the Thompson mine was sunk to an initial depth of 2100 ft. This is connected to the 1057-ft No. 2 development shaft at the 400, 600, 800 and 1000-ft levels. Orebodies are mined principally by horizontal cut-and-fill methods. By the time full scale production has been reached, some 120 cut-and-fill stopes will have been developed.

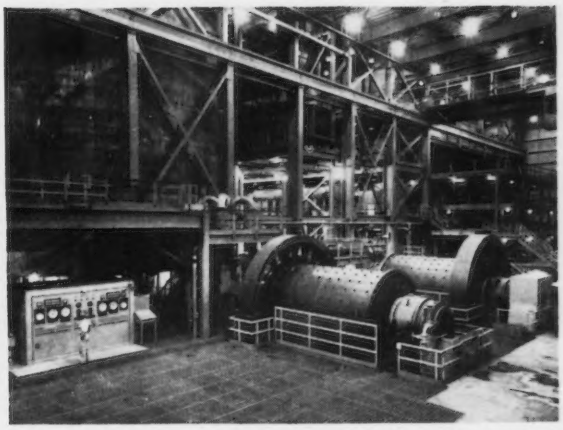
Broken ore is hauled by underground rail system to a main ore pass near the No. 1 Shaft. Ore flows to a primary crusher station below the 1600-ft level. Ore is hoisted from underground crushed ore bins by a friction-drive hoist installed near the top of the 264-ft No. 1 Shaft headframe. Skip capacity is 15 tons; hoisting speed in counterbalance is 2650 fpm.

Mill Capacity Is 5000 tpd

The mill is designed to treat 5,000 tons of ore per day. Two-stage cone crushing reduces ore to size for grinding by rod and ball mills in closed circuit with hydro-cyclone classifiers. Nickel concentrate, extracted by flotation, is pumped to the Thompson smelter, while relatively small amounts of copper concentrate are shipped

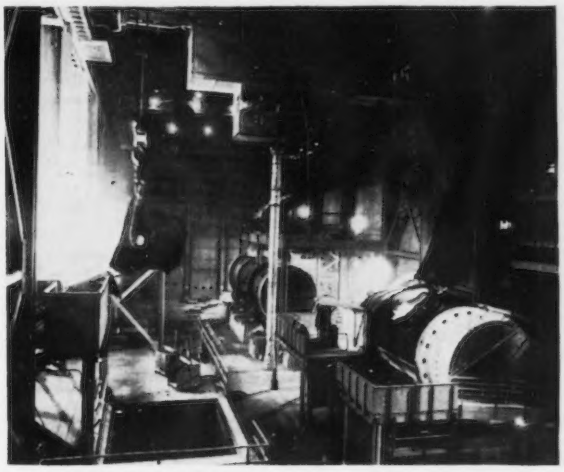


THOMPSON OREBODIES are being mined principally by cut-and-fill methods. Miners, above, drill for rock bolting.



CONTROL PANEL at left indicates high degree of automation in the grinding and cyclone classification section.

NICKEL FLOTATION CONCENTRATES are filtered and given a fluidized roast before going to electric furnaces.



CONVERTER and holding furnaces of smelter are shown at right. Ladle returns slag to one of three electric furnaces.

elsewhere for treatment. Mill tailings are deslimed in hydro-cyclones and used in the mine as backfill. Slimes are pumped to a disposal area.

Smelter Furnaces Are Electric

As shown in the accompanying flowsheet, the nickel concentrate is thickened, filtered and charged into one of three fluid-bed roasters. Then it is carried with the gas stream from the roasters into refractory-lined cyclones where solids settle out and drop to a furnace feeding mechanism. Gases are used to heat waste-heat boilers and then combined with gases from the electric furnaces and converters for treatment in a Cottrell precipitator for recovery of dust before discharge into the 500-ft smelter stack.

Roasted concentrates are smelted in three 1800-kva electric furnaces. Furnace matte is transferred in ladles by 60-ton overhead crane into one of four converters where iron is oxidized and removed as slag. Converter slag is recycled to electric furnaces, granulated and pumped to discard. Molten nickel sulphide, or Bessemer matte, is transferred to holding furnaces.

New Refinery Process

Bessemer matte is cast into anodes for the refinery. Anodes are dissolved electrolytically in tanks to produce pure cathode nickel. This direct electrolysis process, which eliminates more high temperature oxidation and reduction steps, is a recent development, and has been used successfully at the company's nickel refinery at Port Colborne, Ontario.

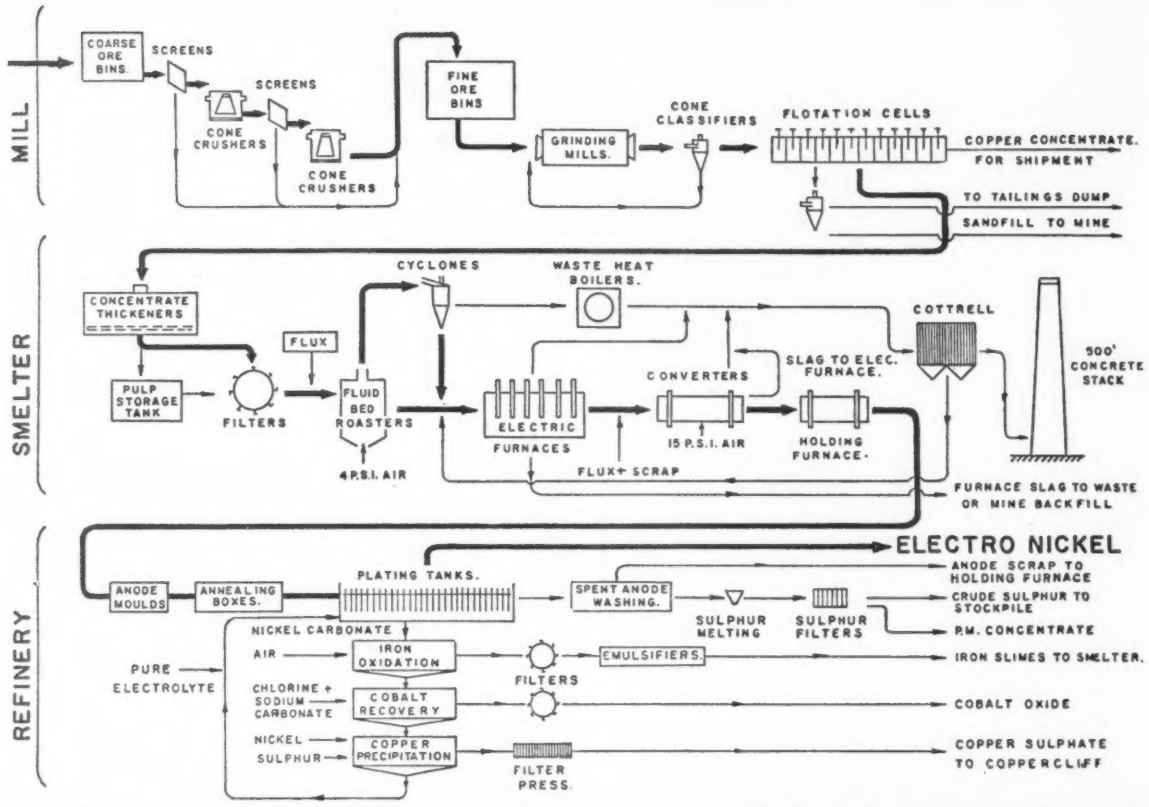
Electrolytic solutions are treated for impurities and the recovery of cobalt which is shipped as an oxide. Spent anodes, together with an adhering high-sulphur residue, are crushed and washed. A filter cake obtained from the washings is melted and the sulphur is removed, leaving a precious metals residue which is shipped to the Copper Cliff refinery for further processing.

The cathode nickel is sheared in the refinery and then shipped according to customer requirements to markets in Canada, the U.S., the United Kingdom, Western Europe and other industrial areas of the free world.

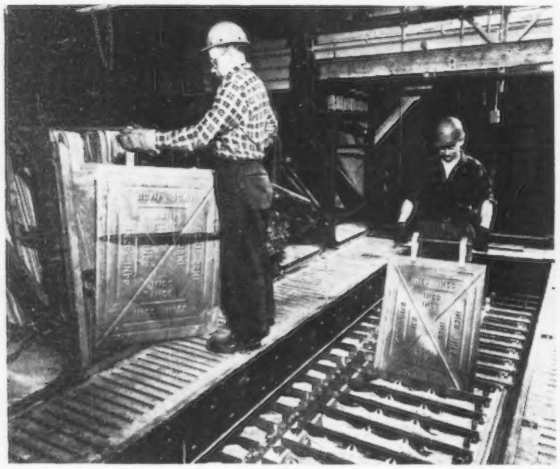
Power for the Project

The Kelsey power plant at Grand Rapid on the Nelson River, 53 miles northeast of Thompson, was constructed by the Manitoba Hydro-Electric Board. Inco assisted the Hydro-Electric Board in financing the Kelsey plant by means of a $20-million loan at low interest rate. Built at a cost of $45-million, the plant has five units with a capacity of 210,000 hp, and provision for expansion to serve other industries drawn to the region by the Thompson development.

Flowsheet for Thompson Mill, Smelter and Refinery



MILL CAPACITY is rated at 5,000 tpd. Refinery capacity is 75-million lb of nickel per year. Direct electrolysis for production of cathode nickel is a new efficient extractive process developed by Inco's research staff in Ontario.



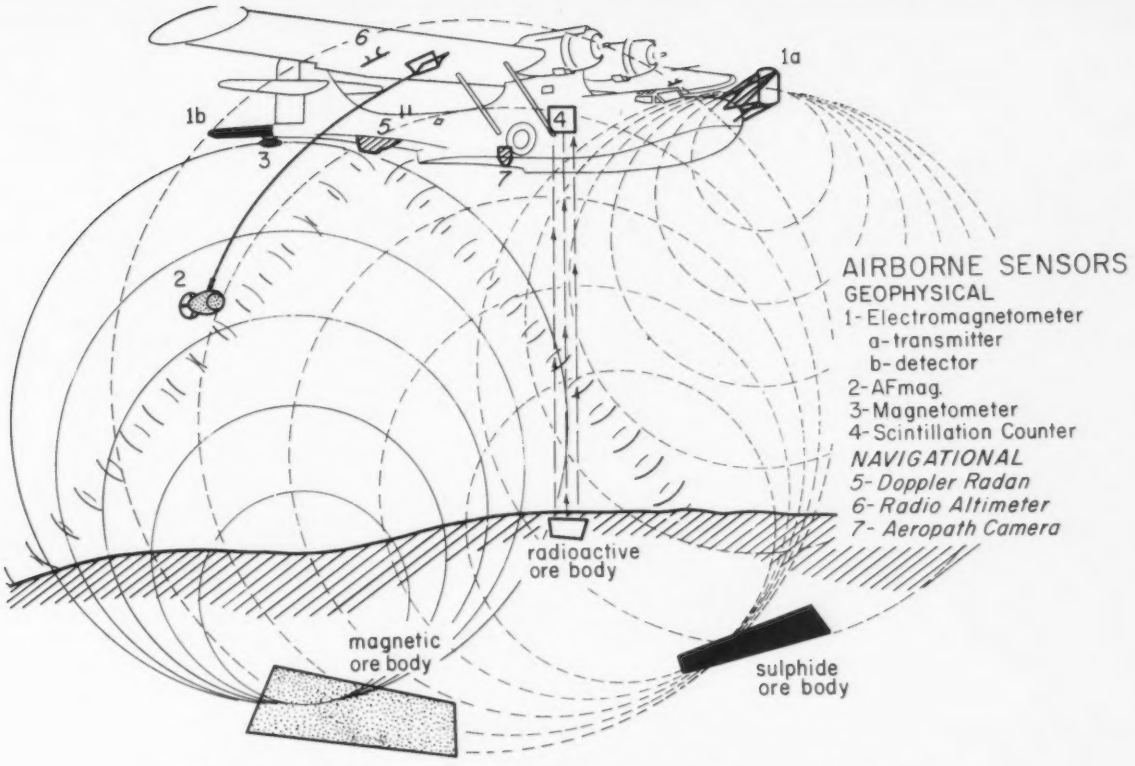
WORKERS in Thompson nickel refinery charge first starting sheet to the electrolytic tank. Anodes are shown in place.

TOTAL COST of Thompson townsite will be about $8.5-million. More than 1,300 people now live in Thompson.

Thompson Townsite

More than 1300 men, women and children live at Thompson now. Inco's expenditures in the development of the townsite are estimated at $8.5-million, over $7-million of which has already been spent. The company provides sidewalks, roads, three elementary schools, a high school, an administration building, fire station, sewage disposal plant and water mains. Because the town is free of debenture debt, local homeowners can enjoy relatively low tax assessments.

The 250-acre plantsite includes a modern office building, metallurgical laboratory, mine changehouse, warehouse, shops, garage, firehall, compressor building, power station and pumphouse.



CANSO AMPHIBIAN is equipped with the most modern geophysical gear available.

Geophysical Re-Survey for Surinam Jungle

AN AMPHIBIAN CANSO PLANE has been equipped with approximately a third of a million dollar's worth of geophysical, photographic and navigational gear by Canadian Aero Service, Ltd., Ottawa, Canada, to conduct a follow-up survey of Surinam now under way. The initial survey, covering approximately 60,000 sq. miles with airborne magnetometer and scintillation counter, yielded a complete set of aeromagnetic maps revealing anomalies meriting a closer look with more penetrating and refined geophysical equipment. (See E&MJ June 1960, pp 104-113)

The above drawing of the Canso "Explorer 1", which with stinger is longer than an Electra turbojet, shows the various fields of force that are investigated, generated or used to explore subsurface geology, guide the plane unerringly along predetermined flight lines (Doppler radar), maintain and record altitude (radio altimeter), and record the flight path of the plane continuously (Aeropath camera).

Four geophysical probes installed on the plane include: (1) the Canadian Aero electromagnetic (EM) system, with a high sensitivity in-and-out-of-phase unit previously available only in helicopter surveys. The EM device is designed primarily to determine the presence of conductors in the ground, and is much more sensitive than early EM devices used in geophysical surveys. (2) The Gulf Mark III magnetometer has been used for more than 15 years in airborne mineral searches. (3) A sensitive scintillation counter records presence of radio-active minerals such as thorium and uranium. (4) The AFMag detector, developed in Toronto by Stanley Ward and others, measures natural audio-frequency currents in the ground. It supplements the function of EM equipment, and is a highly penetrating unit which determines the position of underground conductors. The AFMag unit and the EM unit cannot be operated at the same time. Hence in areas indicating the presence of conductors, flight lines will be re-run to gather additional information with the AFMag equipment. Combined data will enable geophysicists to determine where conducting mineral bodies are situated, and something of the nature of the mineral deposits. For full description of AFMag principle see E&MJ June 1959, p. 206.

As shown above, several fields of force are generated and/or detected, measured and recorded with the elaborate array of scientific gear on the plane. Light is used by the Aeropath camera to record flight position. Doppler radar guides the plane in flight.

The altitude is determined and recorded with the radio altimeter. A scintillation counter picks up radioactive emanations from the ground. The magnetometer detects and records variations in the earth's magnetic field produced by various concentrations of magnetic minerals in rock formations. The EM coil in the nose produces an electromagnetic field which, when disturbed by conductors in the ground, produces significant signals in the pick-up in the stinger of the plane. AFMag picks up distortions in natural electromagnetic fields produced by conducting bodies in the ground. Regional thunder showers generate pulses in the natural EM fields picked up by AFMag.

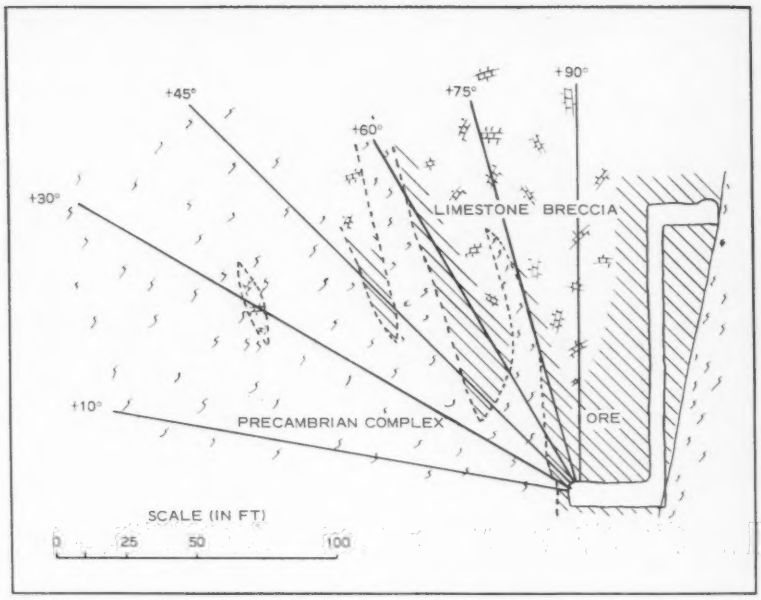


FIG. 1 Typical long-hole station—partial fan. Cuttings from the holes are saved at 4-ft intervals and the composite sample stored in 5x8½-in. sand sacks.

FIG. 2 The drill, mounted on standard arm and column, is drilling a 65° hole.

Percussive Drill Cuts Exploration Costs

B. C. SCOTT

LONG-HOLE PERCUSSIVE drilling has proved the cheapest as well as the most satisfactory method of exploring for additional ore bodies at the Pitch Mine, a uranium producer in the Marshall Pass District, Saguache Co., Colo.

In comparing exploration costs by method, Pinnacle Exploration Co., who operate the mine, found that long-hole percussive drilling cost them 73¢ per ft as opposed to $9.44 per ft for diamond drilling (plus $747 to prepare a station) and $34.27 per ft for drifting (plus up to double that amount for maintenance).

Because the ground is exceptionally hard to hold, exploration drifts, crosscuts and raises are too costly to drive and maintain to make this method of exploration attractive. Diamond drilling, though less costly, has proved to be only partially successful, for core recovery is poor (about 33%) and lost time due to stuck rods is high.

The holes are drilled above the horizontal in "fans" at 50-ft intervals from the haulage level, and from stope floors above the haulage level. Because drilling in the soft Precambrian schists and brecciated Pennsylvanian limestones is relatively easy, the holes can be drilled to depths of up to 200 ft. Cuttings are saved from the holes for check logging, and the holes are probed with a geiger probe pushed into the holes with jointed wooden sewer rods.

Geologic sections are prepared with information from the holes, allowing interpretive mapping of ground without penetration by working headings.

Geology in Brief

THE GEOLOGY is complex, due not to structure in the classic sense, but to plastic flow of incompetent rocks under high structural stresses. Pennsylvanian limestone forms pendants projecting down into soft Precambrian muscovite schists and highly altered pegmatites, with the ore usually associated with the limestone along the contact between the limestone and Precambrian rocks. The limestone pendants are oriented roughly parallel, both in strike and dip, with the major reverse fault on which the mine is located, but do not follow any recognized pattern of occurrence. Not all of the limestone pendants are mineralized, but those that do contain any uranium mineral usually carry enough mineral to make at least part of the pendant mineable. Hence, exploration is aimed first at finding limestone pendants, then in searching for ore in these pendants.

The Precambrian rocks are normally quite soft, due to alteration or brecciation, although discontinuous hard quartz stringers are occasionally encountered in development openings and drill holes. The limestone is intensely brecciated, and for the most part is unhealed, although there is some calcite healing in the barren portions of the pendants. Contacts are distorted, and no bedding planes have been observed. Lenses and distorted bodies of lignite often lie in the limestone, sometimes forming one wall of ore bodies.

The mine is completely timbered, and the stopes are mined by the top-slice method.

Footage & Cost Compared

Long-hole drilling at the Pitch Mine for the 10 months ending October 31, 1960, totalled 14,475 ft. Direct costs for the drilling (excluding amortization of the drill and the original set of drill steel) averaged 73¢ per ft. Footage drilled per hour would not be a reliable figure by which to judge drilling speed, for the total hours

Mr. Scott is resident geologist for Pinnacle Exploration Inc., Gunnison, Colo.

FIG. 3 Geiger probing equipment. Note elbow couplings on rods that push probe.

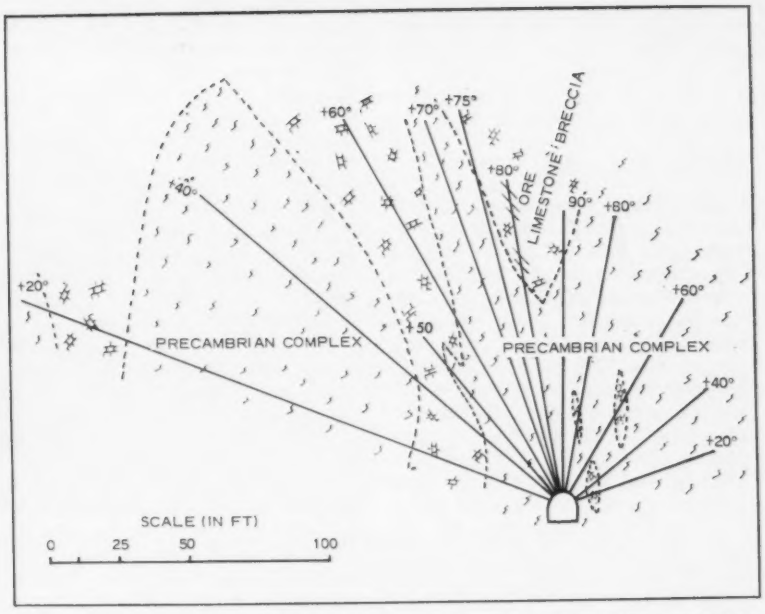


FIG. 4 Typical long-hole station—full fan. Besides saving the cuttings, each hole is probed with a geiger probe, and results of the two methods are compared.

worked by the driller includes set-up time, probing time, etc. It is not unusual for a 100-ft hole to be completed in one day, and as much as 140 ft has been drilled in one 8-hour shift.

Three diamond-drill holes were drilled underground at Pitch Mine by a contract driller in 1960. Two of these holes were down-holes, the other was drilled at plus 5°. The two down-holes, at minus 65° and minus 46°, were drilled 183 ft and 120 ft, respectively. The plus 5° hole was drilled to 105 ft, but the hole caved at 32 ft, and could not be probed. Core recovery from the sections of the holes cored averaged 33%, and footage drilled averaged 18.5 ft per 8-hour shift. Average cost per ft of the holes (plugged and cored) was $9.44, plus $747 to prepare a drill station.

No drifts, crosscuts, or raises have been driven purely for exploration purposes at Pitch Mine. Openings to further explore and develop ore intersected in long-hole drilling averaged $34.27 per ft (direct cost) for 8x10-ft drifts and crosscuts, but subsequent maintenance costs often double the original cost of driving them. The 4x9-ft (inside measurement) cribbed raises used in the mine require little or no maintenance, but the direct cost of driving them averages $32.27 per ft. For reasons of cost alone, development headings are not driven until ore bodies have been partially delineated by long-hole drilling. After the ore is developed, stopes are mined by the top-slice method.

Overhand Drilling Is Used

A vertical fan of holes normal to the general strike of structure is ordinarily drilled at 50-ft intervals from the haulage level. Holes also are drilled from the top floors of the stopes, and a horizontal fan of holes normally is drilled at 30-ft vertical intervals as the floors of the stopes are mined out. All holes are drilled above the horizontal, and when a full semi-circle of holes is desired the low-angle holes are drilled at 20° increments, while the high-angle holes are drilled at 10° increments.

The pendants of sediments are always nearly vertical, so the low-angle holes, which are essentially normal to the dip of the sediments, can be more widely spaced and still penetrate the sediments, but the high-angle holes must be more closely spaced, for they are drilled essentially parallel with the pendants.

Fig. 1 is a section through a typical drill station; in this case a full fan of holes was not deemed necessary. Fig. 4 is a section through a setup from which a full fan of holes was drilled.

Down-holes have been attempted with the long-hole drill, but could not be drilled more than 60 ft. In the down-holes, water return was not great enough to float out the cuttings, and the steel was stuck by cuttings accumulating behind the bit. Horizontal holes are nearly as difficult to drill for the same reason, so all holes other than experimental ones have been drilled at plus 5° or more, to allow gravity return of drilling water.

Cuttings from the holes are saved at 4-ft intervals (corresponding with the changes in drill steel), and a composite sample of each four ft of hole is saved in labeled 5x8½-in. sand sacks. When the drilling program was initiated the geologist logged all drill cuttings, but after the driller had gained some experience in drilling the long-holes, and after rudimentary instructions in hole logging, he was able to log and record the drill cuttings at the time the hole was drilled.

For the purposes of driller logging, rocks expected to be encountered in drilling were divided into four general types: schist, pegmatite, limestone, and coal. Any descriptions beyond these types, changes in drilling characteristics, or abnormal hole conditions, such as a heavy incoming water flow, are recorded in the drilling log by the driller. All drilling samples are brought to the mine office for spot-checking or further study. When the geologist or engineer is satisfied that all of the necessary information has been obtained from the cuttings, the bags are discarded.

Immediately after a hole has been completed, the hole is probed with the geiger probe, and the results of the driller's log and the geiger probe log are compared. Sections then are drawn through partial or full fans of holes to aid in planning ore extraction methods or interpreting mine geology.

At several places in the mine where the ground is excessively soft, the holes could not be kept open long

enough to allow probing. In these cases the cuttings were radiometrically logged, giving at least an indication of the grade of ore or mineralization penetrated.

Drilling Equipment

A Gardner-Denver DH99 drill with automatic screw feed and 4-ft aluminum guide shell is used to drill the exploration long-holes. The drill is mounted on a standard arm and screw column. A double column with a universal mounted crossbar was used when the drilling program was initiated, but was discontinued when the single column mounting was found to be satisfactory. Gardner-Denver Series 400 rod is the only drill steel used, although that rod is considered to be light for the DH99 machine, and is not normally recommended. The 4-ft rods and couplings have a standard G-D "D" thread, and a 2¾-in. carbide insert screw-on rock bit is threaded to the rods by a bit adapter.

The lighter drill-rod was selected for two reasons: (1) Drilling in the soft schists and brecciated limestones was expected to be easy enough so that the strength of the light rod would not be exceeded; (2) longer up-holes could be drilled if the machine did not have to carry so much weight. To date the lighter rod has proved successful, for no steel has been broken in the hole. Couplings occasionally split longitudinally, but this failure usually can be detected before complete splitting is accomplished.

Early in the drilling program it was found that fluctuating water pressure, due to varying uses of water by other mine machinery, often caused stuck rods in the long-holes. To maintain a constantly high water pressure, a 3x2-x3-in. boiler-feed pump was installed in the water line immediately ahead of the drill. The increased water pressure prevented most stuck rods, even in many cases that had previously been blamed on caving holes.

Air for the machine is provided by the mine compressors, with no special air facilities required. Air line pressure is maintained at 100 psi, with minor fluctuatons common during demand periods. These fluctuations in air pressure do not seem to be detrimental to drilling as long as water pressure remains high and constant.

Geiger Probing Equipment

The radiometric-chemical ratio of the uranium ore at the Pitch Mine is nearly 1:1, and the geiger probing method of evaluating ore intersected in drill holes has proved quite successful. A special probe and reel unit, coupled with a standard geiger surface unit, constructed to meet Pinnacle's specifications, is used to probe all holes. The reel is housed in an aluminum box, with a rubber-gasketed lid to keep the brushes and armature dry in the humid underground atmosphere. Except for the reel assembly, and probing rods, the equipment is of the same type that is commonly used to probe surface holes on the Colorado Plateau.

The probe is pushed into holes with jointed hickory sewer rods, with the probe fitted into a sleeve welded to the end of one of the rods. The sleeve is slotted on one side to accommodate the rubber covered cable, and the probe is held in the sleeve by windings of plastic tape. As the probe is pushed into the hole, the 4-ft sections of sewer rod are added by means of cast couplings that require a 90° bend at the joint to allow coupling or uncoupling. This angular requirement prevents the rods from uncoupling as long as they are confined within the drill hole.

The Pneumatic Cartridge Loader

C. H. JOHANSSON

POWDERMEN can now load dynamite cartridges at about the same speed as they can load powdered AN explosives in bulk—and with a considerably greater density.

Such fast, high-density loading can be done with an air-powered cartridge loader developed by the Nitroglycerine Co., Sweden. The patented cartridge loader is important for two reasons: First, it permits the powderman to use most of the available hole space by packing the powder tightly; second, it permits bulk-handling of dynamite.

Tightly packed holes should reduce the amount of necessary drilling needed and bulk-handling makes dynamite cartridges more competitive with AN in the area of materials handling —an area where the use of AN has been a definite cost advantage.

While charging (see illustrations, p. 99), the loading tube is put into the bottom of the drill hole. Compressed air, running through the tube, drags the cartridges from the breech piece to the jet. (The diameter of the cartridges is approximately 1 mm less than the inner diameter of the tube.)

As soon as a cartridge reaches the jet, whose diameter is about the same as the diameter of the cartridge, the exhaust of air is prevented, the pressure in the tube increases and the cartridge is pressed through the jet. In the jet, there are three knives which slice the cartridges. As the loading tube is slowly moved outward with repeated light countermovements, the ejected cartridges are packed to a mass with a high density.

In Sweden, the cartridge loader has become indispensable for underwater blasting (water replaces compressed air for this operation), for blasting without removing the overburden and for long-hole blasting. They are also used increasingly for tunneling and other kinds of rock blasting, thereby replacing rod tamping.

The main reason why rod tamping has remained in use for so long is the demand of safety. In several countries, loading with a tamping rod of wood or plastic is the only method permitted for nitroglycerine explosives. Before the pneumatic cartridge loader with a metallic loading tube (not shown, but which was the earliest type developed) was permitted in Sweden, comprehensive investigation had to be carried out in order to ensure a satisfactory degree of safety.

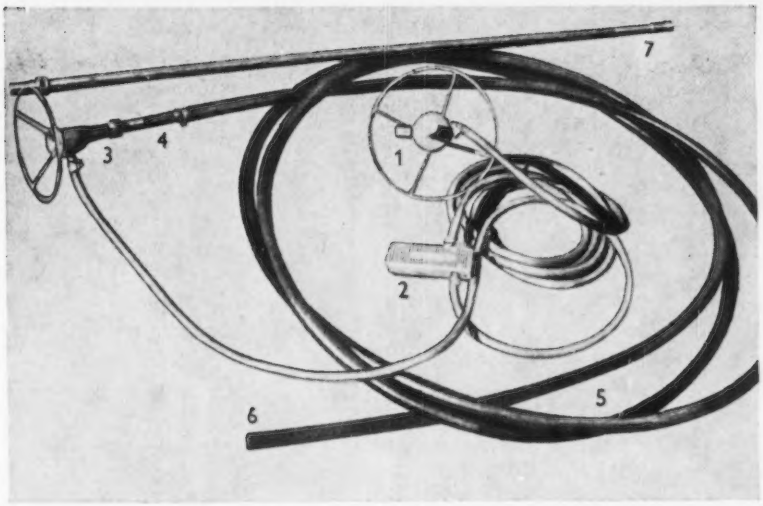
A considerable difficulty was that the knowledge of the mechanism of initiating and the conditions for initiating through impact or friction were and still are incomplete. Therefore, special test methods were worked out that reproduced as far as possible the strain which the explosive would be exposed to at practical work.

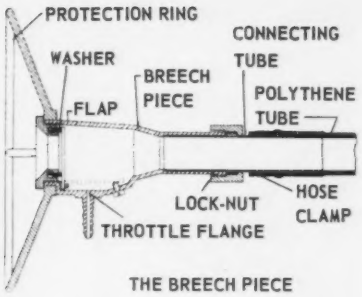
On the basis of the results obtained, the metallic loading tubes are now permitted in dry bore holes for loading a gelatinized ammonium nitrate dynamite with 35% NG (nitroglycerine•nitroglycol). In wet drill holes, the metalic tubes can be used for all gelatinized dynamites including blasting gelatine with 95% NG.

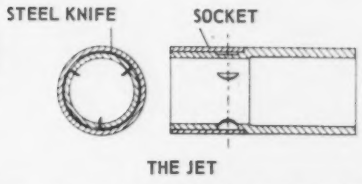
Loading tubes manufactured of antistatic polythene are permitted for all gelatinized dynamites and also for dry holes. The antistatic polythene prevents formation of electrostatic charges.

When charging with the loading

This article is abstracted from a paper entitled "The Use of the Pneumatic Cartridge Loader for Rock Blasting," which was presented by Mr. Johansson at the International Symposium on Mining Research, Rolla, Mo., Feb. 21 to 25, 1961.







THE HAND-OPERATED loader with polyethylene tube has a reducing valve (1), which gives 4 atm when connected to a net for compressed air with maximum 10 atm, and a foot-operated three-way air valve (2) which lets out the overpressure in the loading tube when the valve is closed. The breech piece (3) for inserting the cartridges has a lid which closes automatically when the compressed air is turned on. A 5-mm-dia throttle flange restricts the air supply so that the speed of the cartridges will be maximum 10 m per second. The wheel-like protection ring holds the breech piece above the ground and keeps out gravel, mud, etc. The loading tube (5) is made of antistatic polyethylene with inside longitudinal grooves. The jet (6) has three internal knives and is welded to the loading tube by means of a special welding apparatus. The intermediate tube (7) is, in some cases, placed between the breech piece and the connecting tube to facilitate the inserting of cartridges.

tubes, the diameter of the drill bit has to be at least 36 mm for 22-mm cartridges, 40 mm for 25-mm cartridges and 45 mm for 29-mm cartridges. The metallic loading tubes have the advantage of being usable for drill holes of lesser diameter. They are manufactured for 22-mm and 25-mm cartridges and they can be used for 30- and 33-mm-dia drill holes.

To make a primer, a cartridge is either forwarded through the tube to the jet or a cartridge of somewhat smaller diameter is inserted in the end of the jet. Usually the latter method is preferred. An electric blasting cap is then inserted centrally in the free end of the cartridge and the primer is lowered into the hole with the tube. When the primer is pressed out of the loading tube, the leads should be kept loosely so that they do not tilt the cap.

Apparatus for 25-mm cartridges is usable for drill holes with 40 to 80 mm diameter and they give a density of 1.5 to 1.4 kg/dm³. With this apparatus, one man loads approximately 600 lb per shift and two men load 1100 to 1300 lb per shift in drill holes 50 ft deep.

A modification of the cartridge loader, developed by S. Ljungberg, is the semi-automatic breech piece and the robot loader (Fig. 1 & 2). By using this apparatus, the loading can be carried out more conveniently and more quickly. The apparatus can be operated by one man, who has only to put the cartridges into the breech piece. He can be spared the rather strenuous work of packing the explosive in the drill hole, and he will not be troubled by the returning air with nitroglycerine vapors or the water that is thrown out from wet drill holes.

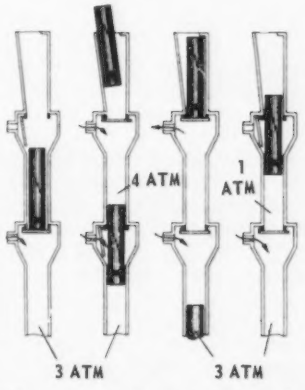


FIG. 1 The semi-automatic breech piece delivers about one cartridge per second.

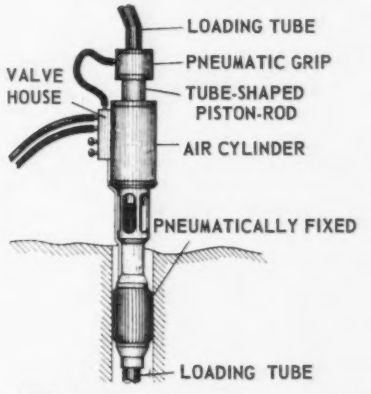


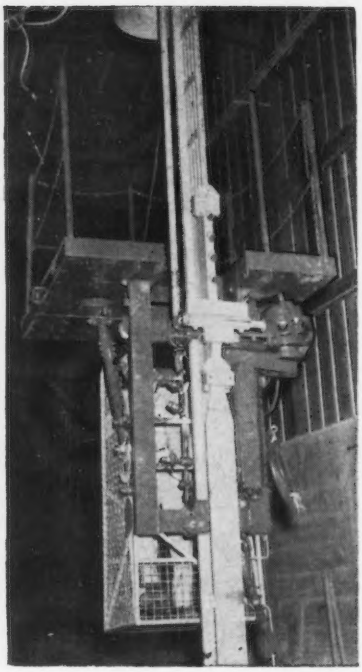
FIG. 2 By varying air pressure of grip, various degrees of packing are obtained.

For good blasting results, it is often desired to pack the bottom of the hole more densely than the rest of the charge column. With the robot loader, different densities can be obtained by varying the air pressure of the grip.

The automatic breech piece, by itself, gives an important increase to the loading speed. It works as a sluice which passes the cartridges into the loading tube leaving some pressure in the tube. Thus, the loading can proceed without intervals for inserting the cartridges. The way it functions is evident from Fig. 1, which shows four stages in the passing of cartridges through the sluice alternatively at 4 atm and 1 atm with a frequency of one per second. This corresponds to a gross capacity of 800 lb per hour for 1-in. cartridges and 1100 lb per hour for 1⅛-in. cartridges.

In loading tests with the semi-automatic breech pieces, but without the robot loader, two men loaded, per hour, three bottom charges of 55 to 75 lb each with 1.3 to 1.4 kg dm³ density in 115-ft-deep drill holes with 3-in. diameters. With good planning and some practice, it may be possible to load 2000 to 3000 lb per two men and 8-hour shift.

DECK CANOPY, 3 x 4½ ft in cross section, was made to protect the miners from falling rock while stripping the guide rail from the raise at the Steward Mine.



ALIMAK is operated from a wire cage that is hung under the drilling platform.

Alimak Succeeds in Difficult Ground

ROBERT B. COX

LEONARD P. COLVIN

AT THE STEWARD MINE in Butte, the Alimak Raise Climber was used in driving a 7 x 7-ft vertical ventilation raise 208 ft in seven weeks, or in 146 man shifts (1.42 linear ft per man shift). Temperature and humidity were high (93° F, relative humidity 90%), retarding over-all performance.

The ground would ordinarily have to be supported by timber. In place of timber, an average of twelve ¾-in. x 4-ft expansion shell rock bolts and six 17 x 60-in. steel mats were installed vertically on the walls of each 6-ft round. The raise climber followed a previously drilled 9-in. rotary drill hole which was used for exhaust ventilation.

Rounds of 6 ft were broken regularly with 22 holes breaking to the 9-in. rotary hole. The rounds were charged with 1-in. diameter 70% Gelex cartridges and primed with ⅓-second delays.

A second raise is being driven on an incline following a 3-ft vein which varies in dip from 57° to 77°. Convex and concave guide rails are necessary to keep the raise in ore.

A comprehensive study was made of the Alimak raise and compared to a 13 x 7½-ft, 6-post framed timbered raise. Both raises were driven in similar ground and temperatures. The study revealed that the Alimak raise increased the ft/man shift 48% and decreased the direct cost/linear ft 33%.

Complete Alimak raise cycles were studied and each phase of the cycle was averaged to establish an average cycle. Approximately 7 hours 39 minutes was required to make a complete cycle. A minimum of three trips were made to complete a cycle (first trip —bar down and install guide rail; second trip—rock bolt for ground support and drill round; third trip—load round).

Useful Additional Equipment

Deck Canopy. A V-shaped solid deck canopy, 3 x 4½-ft cross section, was made to protect the miners from falling rock while stripping the guide rail from the raise. The canopy was made of two pieces of ⅜-in. sheet aluminum bolted to 1½ x 1½ x ¼-in. angle iron. The canopy is supported by four pieces of 1-in. pipe, 6-ft long, welded to the corners of the canopy. The 1-in. pipe is fitted over collared drill steel which is inserted in the deck holes.

Deckhook For Rock Bolt Mats. A hook installed under the deck of the climber makes it possible to hang eight ground support mats under the deck for storage when ascending the raise, and clear the platform during rock bolt and mat installation.

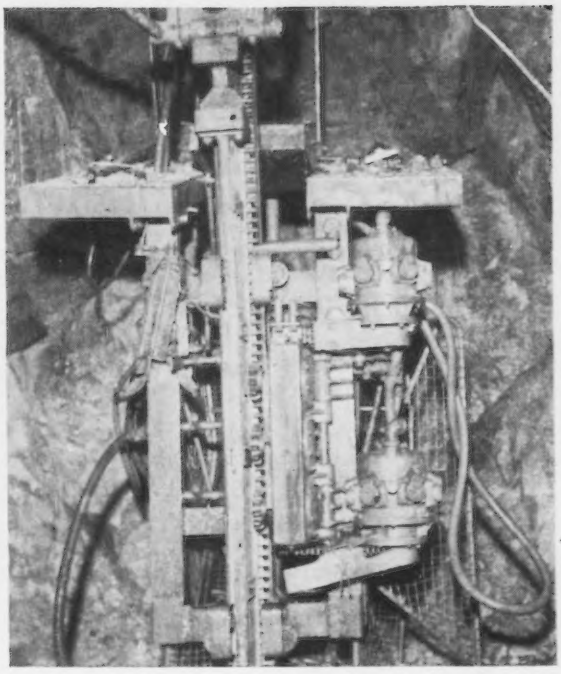
Impact Wrench. An air-operated impact wrench considerably speeds up rock bolting. The wrench is operated from a ½-in. hose connected to the central manifold under the deck of the raise climber.

Bar Down Protection Barrier. A steel protection plate, ¼ x 18 x 12 in., is placed vertically on the deck supported by two pins welded to the plate and inserted in the holes on the deck. The plate can be moved to any desired position on the deck and protects the miners from barred-down rock bouncing on the deck.

Wire-Braid Air Reel Hose. On the first raise, the trailing air hose was broken frequently by falling rock during the barring down and drilling

Mr. Cox is the foreman of the Steward mine. Mr. Colvin is assistant research engineer for the Anaconda Co. at Butte, Montana.

RAISE CLIMBER is lowered from the brow by an air tugger rock-bolted to the wall. Hook underneath deck stores 8 mats.



TWIN 6.2-hp. air motors were installed on the Climber to increase load capacity. Note ground support mats in background.

at Butte

phases. A wire-braid hose was installed on the reel for the second raise. No further damage has occurred.

What It Is

The Alimak Raise Climber is essentially a platform elevator that carries mining equipment and men up and down the raise on a sectional guide rail that is rock bolted to the hanging wall of the raise. The rail comes in one and two-meter lengths and incorporates four 1¼-in. air and water service pipes. The men operate the climber from a wire cage that is hung under the drilling platform. The 63-in. square drilling platform serves as a protection roof for the men while ascending and descending the raise.

The motive power is supplied by a 6.2-hp compressed air motor driving a worm and three pinion gears meshed to the guide rail rack. The motor receives its air from a 1¼-in. trailing hose which is fed from a reel located on the sill. The reel has an air motor that automatically takes up the slack in the hose. The raise climber is able to ascend a vertical raise 33 ft/min at 90 psi, carrying drilling equipment and two men. Adjusting arms permit the platform to be kept horizontal in an inclined raise.

Timestudy Results

Phase	Man Min/Cycle (2 men/shift)	% Of Cycle
1. Lowering and raising climber at brow	20.06	2.18
2. Lubricate climber	6.34	0.69
3. Climber travel time (avg. 3.18 trips/cycle) (Raise inspection increased travel time)	48.02	5.23
4. Barring down back of raise	62.96	6.86
5. Complete installation of 2 meter track	74.58	8.12
6. Drill for and install 12 rock bolts & 6 mats	185.45	20.19
7. Drill round, set up and tear down time	199.82	21.74
8. Load and blast round	86.70	9.44
9. Procure supplies, load, unload climber	46.36	5.05
10. Slush round (avg. 7-57 cu ft cars/round)	73.78	8.03
11. Supervision, lunch, rest	114.52	12.47
		100%

Total man minutes: 918.59
or 7 hour 39 minute cycle (including 30 min. lunch)

Equipment Used

1. **Drills** ..... 2 direct striking stopers (drilling round). 1 airleg (drilling rock bolt holes).
2. **Bits** ..... 1⅜-in. and 1¼-in. tungsten carbide one-use rock bits. (1¼-in. holes are required for Alimak track installation.)
3. **Caps** ..... ⅓-second electric delays.
4. **Powder** ..... 1 x 8-in. 70% Gelex cartridges.
4. **Rock bolts** ..... ¾-in. expansion shell.
6. **Mats** ..... 17 x 60-in. punched hole type, landing mats.
7. **Slusher** ..... 25-hp electric, double drum.
8. **Scraper** ..... 34-in.

A New Way to Evaluate Explosives: Ft-tons Energy per Dollar Expended

SPENCER CHEMICAL CO. has developed an explosives testing and rating method that relates useful energy to cost; that is, it gives the total useful energy per dollar cost of the explosive (see Table 1). The table also indicates the marked effect of different initiation systems on the energy-per-dollar rating of prills plus fuel oil.

In explaining the method, Spencer also points out some of the flaws of conventional testing methods and emphasizes the importance of thrust energy as well as shock energy for breaking rock.

The testing method is based upon the use of water as the blasting medium. Water has closer physical properties to rock than the conventional steel tube or lead block. Furthermore, thrust energy as well as shock energy can be measured.

The thrust energy, which can be directly related to the bubble produced by an explosion under water, accounts for the heaving action of AN-fuel oil mixtures. It explains why the mixtures perform better than would be expected from theoretical calculations of shock energy (based on the velocity of propogation of shock waves by an explosion in a lead block or steel tube).

By utilizing the non-ideality of ammonium nitrate, the energy developed can be varied according to needs, i.e., in harder rock a greater amount of shock energy would be helpful and, in the case of softer materials thrust or bubble energy would give proper fragmentation of the rock formation. By varying the boostering techniques, the AN-fuel oil mixture can be adjusted to provide more of the type of energy that is desirable for the rock formation in which the explosive is being used.

Early studies of AN-fuel oil mixtures have been largely dependent upon actual propagation velocity measurements of long cylindrical charges. These charges, generally encased in a steel tube, have been used also to measure the relative efficiency of various mixtures and initiation systems.

The principal weakness of this system is that the data accumulated apply to a highly specialized situation which is quite unlike anything that could be anticipated in commercial blasting. The steel tube is not only a much better reflector of the initial shock wave than the walls of a bore hole, but also once broken, offers virtually no resistance to the expansion of the reaction products such as the rock or burden in a commercial blasting operation would.

In the early stages of the detonation reaction, (which are primarily responsible for initiation) the propagation takes place under high confinement, while in the later stages the confinement is little more than a bare charge in air. This combination of conditions could be expected to produce the following:

1 Mixtures which might not sustain detonation in the bore hole of a given size might do so in the steel tube of the same size because of the great confinement.

2 A given mixture may be effectively more sensitive to initiation in the steel tube than in a bore hole.

3 The afterburning or the gas expansion which for some mixtures would go to completion in a bore hole might be easily quenched by the expansion after the bursting of the tube.

In addition to the effect of the specialized confinement upon the reaction, shock wave and blast energy transfer from the explosive to the steel and from the steel to the air is quite different from the direct transfer from the explosive to the burden in a blasting operation.

The Spencer method was developed from methods used by the military. In the case of military explosives, detonation velocity gives accurate estimates of the detonation pressure, the energy liberated in the reaction, and the general effectiveness of explosive. For ammonium nitrate-fuel-oil mixtures, however, observed reactions are significantly non-ideal. In other words, only a fraction of the energy contributes to the propagation of the detonation.

This does not necessarily imply that the remainder of the energy is unavailable for the accomplishment of useful work. On the contrary, a large fraction of energy may be available in forms more useful for commercial applications.

Because of this non-ideality, the propagation velocity is somewhat a less complete characterization of the detonation of AN-fuel mixtures than of compounds used by the military. Measurements of output, which are often a mere check and refinement of theoretical calculations for military explosives, are essential to the determination of the reaction completeness and the effectiveness of AN-fuel mixtures.

Many systems have been used to measure explosive output. In each, the output is influenced by surrounding or butting medium. Air, rock, steel, lead and earth have been used in one test or another as a receiving medium. Each medium has its advantages and disadvantages in terms of the convenience of the experiments and the significance of the measurements. Of the possible media, water was chosen for the output measurements because of the following advantages:

A The properties of water are reproducible and homogeneous.

B Complications introduced by the rigidity of solids are eliminated from the interpretation of data. Organizations associated with naval warfare have developed interpretation of underwater explosion phenomena to a high state.

C Underwater shock energy, which is closely related to that which causes the shattering of rock, and the bubble energy that is analogous to energy that produces the heaving action of blasting explosives, account for most of the available energy in an explosive. These are the data which are being developed in the underwater testing program. Ultimately these two forms of energy can be related to rock blasting in terms of foot-tons of energy per dollar expended.

D The properties of water fall well within the range of materials which are subjected to commercial blasting so that underwater interaction effects are more typical than those of the air blast experiments or the Trauzl lead block test.

Table I (a portion of the original experiments) indicates that ammonium nitrate-fuel oil can be altered to some degree with the initiation system. This particular group of figures is based on explosive energy per unit cost. Table II is a summary of the thrust or bubble energy of the charges which were fired on July 12, 1960. The figures given are not the total energy output of the explosive, but only that of the bubble. The computations necessary to arrive at the shock energy are quite involved and will require some time to complete.

In Table II, however, the effects

of the properties of the ammonium nitrate solid, the coating of the ammonium nitrate solid, and the variation in boostering of ammonium nitrate-fuel oil mixtures are apparent.

For instance, it was easy to see that varying the density produces pronounced effects. The reason for this phenomenon is relatively simple. When the recommended 6% fuel oil is added to a high density nonporous ammonium nitrate, it can, of course, only coat the particle. Since it has been well established that the deflagration of a grain of explosive progresses layer by layer from the surface of the particle to the interior, a condition exists whereby the outer layer of the ammonium nitrate is in contact with an excess of fuel and the inner portion of the particle has a deficiency in fuel.

The energy output as well as the detonation velocity of ammonium nitrate-fuel oil mixtures which are either fuel-rich or fuel-lean are less than that of a mixture which is nearer the stoichiometrical balance. In other words, a condition exists where the detonation is initiated in a fuel-rich layer and, as the deflagration progresses inwardly on the particle, the mixture becomes lean in fuel. So at no time during the detonation process of the particle is the fuel and oxidizing agent in balance. This is a condition which creates both the initiation problem and the lower output.

The difficulty that arises with the diatomaceous earth-coated prill is similar in some respects in that the DE coating has a much greater ability to retain the oil than does the ammonium nitrate, thereby reducing oil distribution in the particle. In the uncoated prill, this problem is somewhat alleviated. The structure of the prill is such that the fuel can penetrate the particle so as to maintain a better fuel balance throughout the detonation of the individual particle. It is not claimed necessarily that this balance is perfect throughout the particle; however, a larger portion of it is more nearly balanced than other types of ammonium nitrate solids.

Table I Underwater Explosion Tests

Test No.	Explosive	Initiation System	Charge Weight, lb.	Useful Explosive Bubble Energy per Unit Cost ft-tons/dollar	Useful Explosive Shock Energy per Unit Cost ft-tons/dollar	Useful Explosive Energy per Unit Cost ft-tons/dollar
1	94/6, N-IV	3 in. 100 gpf PC, #6 ebc	1.0	5700	800	6500
4	Ammonium Nitrate Prill + Fuel Oil	6 in. 100 gpf PC, #6 ebc	3.0	7300	1100	8400
5		4 in. 100 gpf PC, #6 ebc	8.0	11100	1500	12600
7		3 in. 400 gpf PC, #6 ebc	1.0	9500	500	10000
8		6 in. 400 gpf PC, #6 ebc	3.0	11200	1000	12200
9		125 40% gelatin extra, #6 ebc	1.0 total	8500	1700	10200
11		245 g 40% gelatin extra, #6 ebc	3.0 total	11400	400	11800
13		295 g 60% high pressure gelatin, #6 ebc	8.0 total	12500	1700	14200
15	Ammonium Nitrate Prill + Molasses	10 ft. 400 gpf PC, #8 ebc	8.0 total	5400	1700	7100
18	400 gpf Primacord	#8 ebc	0.57 (10 feet)	130	60	190
23	40% gelatin extra 1¼ in. dia.	#6 ebc	0.28	1220	550	1770
24	60% high pressure gelatin, 2 in. dia.	#6 ebc	1.30	1480	320	1800
27	TNT		1.00	1560	840	2400

Table II Underwater Explosion Tests Coal City, Illinois, July 12, 1960

Test No.	Explosive*	Initiation System	Bubble Period (milliseconds)	Bubble Energy ft-tons/pound
1	8 lb coated AN (3% D. E.)	12" 400 gpf Primacord	222	136
2	8 lb N-IV AN	12" 400 gpf Primacord	315	386
3	8 lb commercial blasting agent	12" 400 gpf Primacord	199	98
4	8 lb pelleted AN	12" 400 gpf Primacord	204	105
5	8 lb coated AN (3% D. E.)	36" 400 gpf Primacord	285	286
6	8 lb grained AN	12" 400 gpf Primacord	100	12.4
7	8 lb Rollex	12" 400 gpf Primacord	299	331
9	27 lb N-IV AN	Spencer Booster (9½ oz.)	455	344

*No. 2 diesel fuel was added to all products at 6% by weight. All were mechanically mixed.

Shock or Impulse Energy

Measurement of the area under the initial pressure-time of each charge provides magnitudes of impulse. In impulse measurements, pressure duration and pressure magnitude are considered. Impulse, therefore, provides quantitative information as to the effectiveness of the blast. Integration of the pressure-time curves as a function of pressure squared provides the magnitudes of the energy flux density. Energy flux density, or shock energy as it is sometimes called, is a measure of the work done on a surface fixed in a medium through which the shock wave is traveling.

Shock energy is quite closely related to energy which causes shattering and spalling of materials experiencing strong shock waves. The quantity of a given material which may be shattered or crushed by explosion is closely related to the shock energy. When the shock wave reaches a free surface it is reflected as a tension wave. When the tensile stress exceeds the tensile strength of the material, this material separates. This action is known as spalling and is an important factor in parting of solids by explosives. Some investigators have demonstrated that this action is a pertinent mechanism for rock breakage in mining operations.

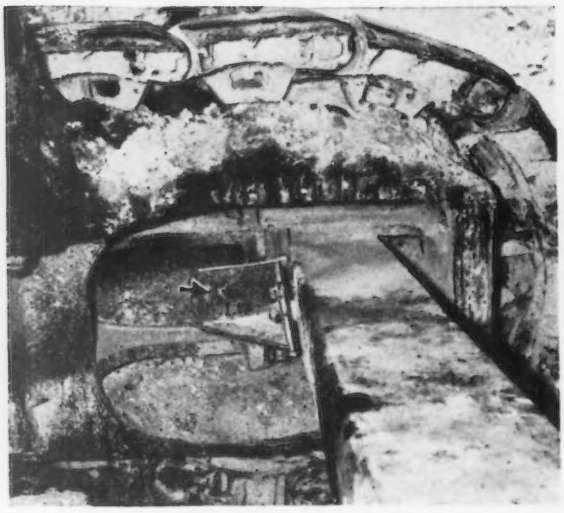
The second event in underwater explosions is the bubble. When an explosive charge is detonated, gases under high pressure are rapidly evolved. The water in the immediate vicinity of the gas bubble attains a high outward velocity and the bubble expands rapidly. This expansion continues aided by the inertia of the surrounding water. After the gas pressure in the bubble falls below the pressure of the surrounding medium, the expansion stops when the outward momentum is lost. The gas bubble then begins to contract very quickly. In effect, the elastic properties of the gas and water along with the inertia of the water provide conditions for an oscillating system. The gas bubble undergoes repeated cycles of expansion and contraction. The energy of this bubble is measured by the time of the bubble oscillation, which gives a measure of the size of the bubble.

The period of oscillation of the bubble is directly related to the internal energy of the gas bubble. This energy is usually termed bubble energy or thrust energy, and is analogous to the property of blasting explosives which produces a heaving or pushing action on the surrounding medium.

These factors, of course, point up the varying needs for the two different types of energy. In many cases, for instance, the natural fracture pattern already established in the rock is sufficient so as not to require a great amount of shattering, but displacement is the greatest need. In this particular instance, of course, shock energy is not a great requirement, but rather bubble energy is the more useful type of energy.

As can be seen, even within the relatively few combinations of conditions represented in these data it is possible to pick out combinations which maximize one quantity while minimizing another.

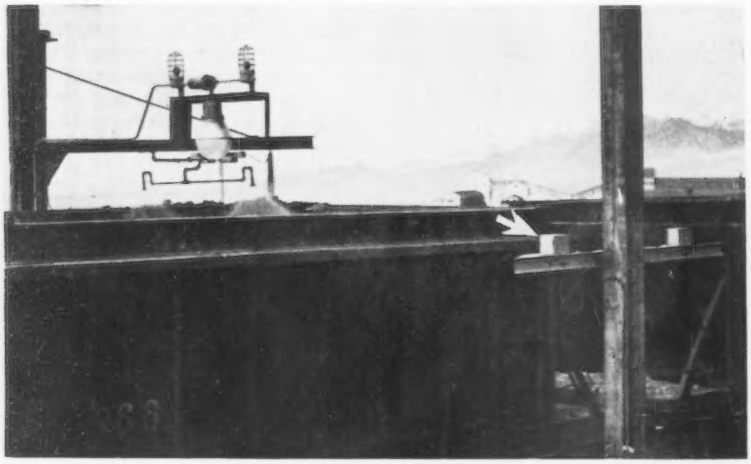
OPERATING IDEAS



Reinforcing Inserts Increase Life of Track Drive Tumblers

THE NEVADA MINES DIVISION of Kennecott Copper Corp., Ruth, Nevada, is getting a longer life out of track drive tumblers on the 110-B electric shovels operating in the Liberty pit by welding inserts made from heavy steel plate into the hollow sprocket segments of the tumbler, as shown in the photograph at the left. The reinforcing job is done on each new drive tumbler before actual installation.

Another alteration made on the shovel caterpillar track system that has proved most satisfactory is shown in the photograph at the right. Here, the change involves use of a simple shim arrangement in place of the conventional take-up bolts for tightening the track belt proper. Both ideas were submitted by members of the Ruth mines plant maintenance department.



ELECTRIC EYE units (arrow) operate the sprays for the entire length of each car and cut them off during the interval between the car ends (coupling area).

Magnesium Chloride Spray Prevents Frozen Ore Cars

AN INTERESTING and effective installation at the concentrator of Kennecott Copper Corp., Nevada Mines Division, McGill, Nevada, is an automatically operated spray arrangement used during extremely cold weather to treat the interiors of dumped ore cars with a magnesium chloride solution to prevent freezing of ore subsequently loaded into them at the mines at Ruth, some 22 miles distant.

The ore is brought to the concentrator in trains made up of fifty 75-ton cars, which are dumped into the storage bins ahead of the primary crusher by rotary car dumpers. Prior to the installation of the spray plant, much time was lost during the winter months in torching frozen cars, causing extra labor expense and reduced crusher operation. This difficulty has been reduced to a minimum by the simple plant to be described.

As built, it consists of a tank car capable of storing some 7200 gal of magnesium chloride solution spotted on an elevated track siding near the car dumpers; an automatically controlled centrifugal pump powered by a 15-hp motor mounted on the tank car and connected to the pipe system leading to the spray head; a head with twin sprays attached to a steel bracket or gantry extending from a steel column rising on one side of the track; and the electric eye installation mounted on a steel cross bar on the steel column rising on the other side of the track.

Operation is simple. No extra crew is required. After loaded train has passed through the rotary car dumpers, it is switched back to the main track and run at slow speed below the spray head mentioned. The electric eye units operate the sprays for the entire length of each car and cut them off during the interval between the car ends or coupling area. Only 7 minutes are required to spray the 50 cars of an ore train.

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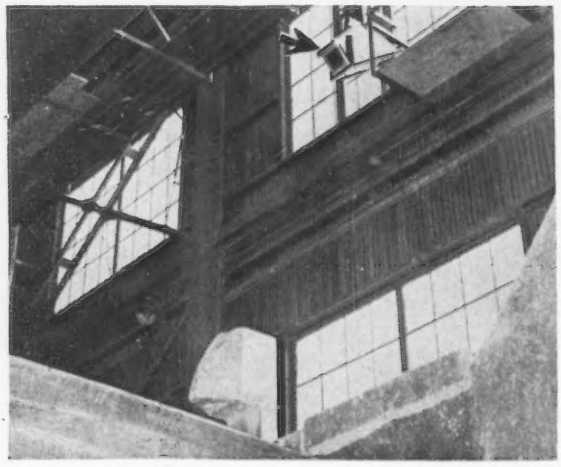
OPERATING IDEAS *(Continued)*

Wheeled Table for Removing Locomotive Couplings

GENE STODDARD, machinist employed in the Ruth mines plant maintenance department of Kennecott Copper Corp., Nevada Mines Department, Ruth, Nev., devised the coupler table shown for use in the repair shop given over to servicing the large diesel-electric locomotives of the Ruth-McGill ore haulage system. It enables the operator to remove or change couplers between locomotives with a minimum of lifting and handling, as well as providing extra safety for him while carrying out the job. The coupler table is of simple design and consists of a 4-wheel truck supporting the pyramid-like table structure made from heavy angle irons. All parts making up the table were made from salvage materials.

A Novel Air Saw Repair

THE accompanying photograph shows how Lewis (Bud) Fuymon, machinist employed in the mines plant maintenance department of Kennecott Copper Corp, Nevada Mines Division, Ruth, Nevada, solved the problem of piston wear on air saws. As seen, the modification made involves placing a steel insert in dovetail of aluminum piston. This prolongs the life of the piston at least three times its usual period.



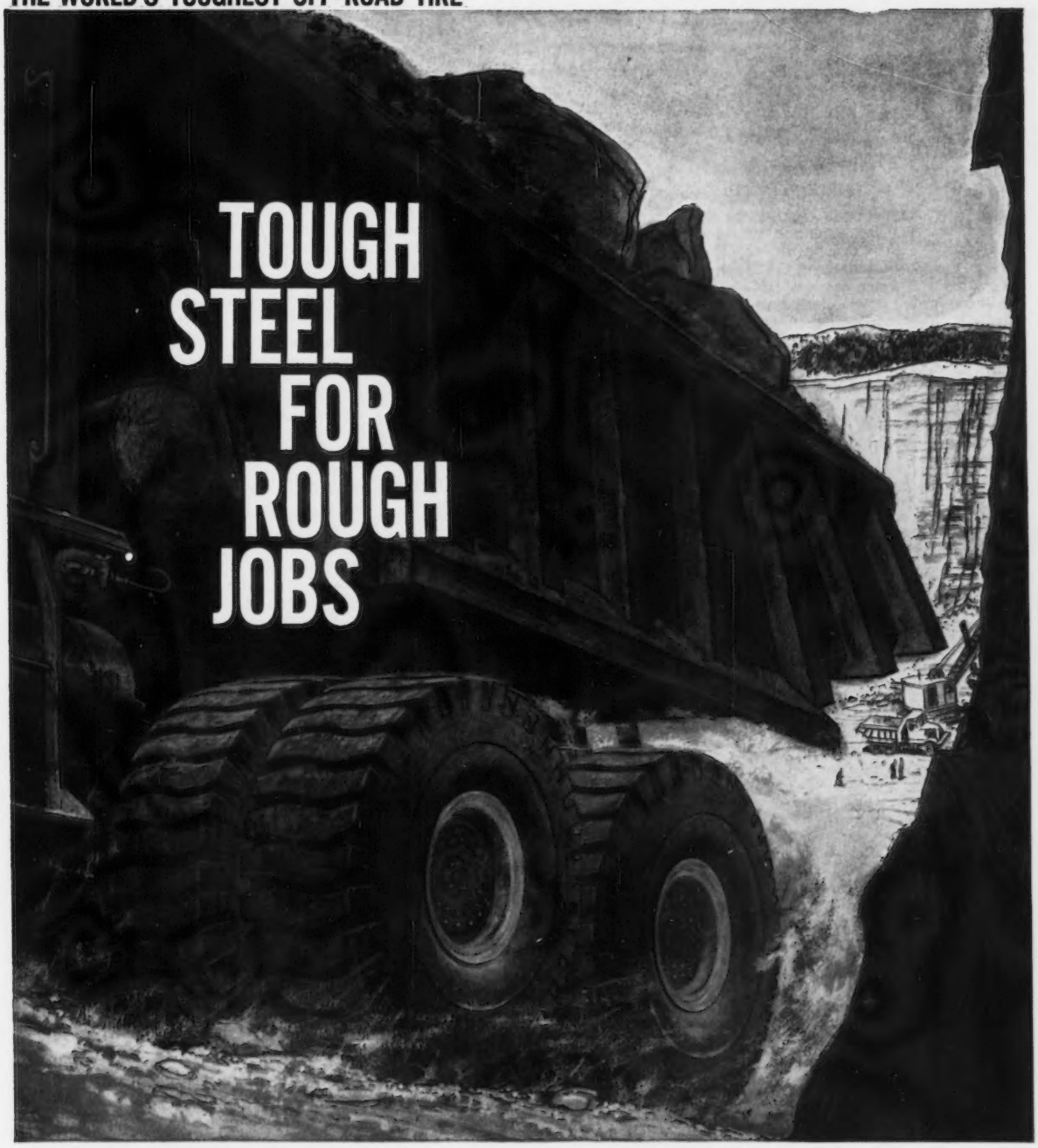
KCC Installs TV System for Car Dump Control

A CLOSED CIRCUIT industrial television system has been installed by Kennecott Copper Corp., Nevada Mines Division, McGill, Nev., for safe and effective supervision of the rotary car dumper at the head of the large concentrator. The installation has proved reliable and easy to operate.

The key units consist of a TV camera installed high above the rotary car dumper, as seen in the accompanying photograph, and a picture screen on the floor of the primary crusher below.

By watching the screen, the crusher operator can observe car dumping operations at all times. Particularly he can see that clamps are in holding position on the ore car, and he can look for large rocks that may lodge in the crusher. With the control panel next to the screen, he can take immediate action should a car be not properly secured by the clamps or should large rocks impede the flow of dumped ore to the crusher.

THE WORLD'S TOUGHEST OFF-ROAD TIRE



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WHAT'S NEW IN PATENTS

OLIVER S. NORTH

U. S. PATENTS

Mining

In an improved mine hoisting system, a pair of ropes connects the skip to the drum, and the rope ends are passed in opposite directions around the wheel assembly, and secured thereto. Tension is equalized, and the chance of disaster from a broken rope or ropes is minimized. R. Blair, assigned to Anglo American Corp. of South Africa Ltd. U.S. 2,969,854.

Design for a muck bailer for cleaning mine shaft bottoms. The bailer dipper is attached below the skip and automatically fills with muck each time the skip descends to the shaft bottom. L. Taylor and L. C. Brown. U.S. 2,969,886.

Metal & Mineral Processing

In a process for recovering uranium-enriched concentrates from low-grade iron-containing ores, the ground ore is roasted at 480-510°C, whereby a ferromagnetic uranium-bearing fraction is formed. This fraction is separated from the rest of the ore by a dc magnetic field. R. M. Tripp, assigned to Tripp Research Corp. U.S. 2,965,440.

Design for a low-cost gravity concentrator of the wet type for achieving clean and complete separation of flour gold from gangue materials found in placer sands. H. P. Rock and C. S. Toone. U.S. 2,969,147.

In the recovery of borax or other boron values from natural brines, an open-chain aliphatic polyol is added, and the resulting boron-enriched solvent separated and acidified. D. E. Garrett, assigned to American Potash & Chemical Corp. U.S. 2,969,275.

Improved apparatus for wet classification of black sands or like materials consists of a helical launder having inlets for raw sand slurry and outlets for tapping off the various mineral fractions. A. Grunberg. U.S. 2,969,877.

In the recovery of lead-free nickel, cobalt, silver, or copper from ore leach solutions, the clarified leach solution is contacted with a hydroxide floc of titanium, vanadium, chromium, magnesium or iron. The lead is adsorbed onto the floc, and the floc is then separated from the solution. V. N. Mackiw and N. Zubryckyj, assigned to Sherritt Gordon Mines Ltd. U.S. 2,970,051.

Method for recovering a satisfactory copper electrolyte from oxidized copper ores, such as those of Mineral Hill, Ariz. The ore is leached with a solution of sodium hydroxide or potassium hydroxide, and the ore particles scrubbed during leaching so as to remove silica gels therefrom and continuously expose fresh surfaces for leaching. F. E. Horton, assigned to Banner Mining Co. U.S. 2,970,096.

Simplified froth flotation—gravity separation process for producing separate phosphate and heavy-mineral concentrates from phosphate ores containing small amounts of heavy minerals. H. E. Uhland, assigned to International Minerals & Chemical Corp. U.S. 2,970,688.

Copies of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D.C.

Improved froth flotation of barite from ores thereof is obtained by adding to the mineral pulp a propotioned mixture of an alkyl half-sulphate ester, e.g. sodium cetyl sulphate, and a fatty acid, and maintaining the pH at 9.5 to 11.0 during flotation. Consumption of reagents is lowered, size of the recirculating middling fraction is reduced, and a froth having excellent mechanical characteristics is produced. R. A. Henderson and O. J. Benston, assigned to National Lead Co. U.S. 2,970,692.

CANADIAN PATENTS

Mining

Design for an improved shovel bucket for mine-shaft mucking machines. The shovel teeth project forward and down along the entry edge of the bucket. D. M. Schwartz, assigned to Eimco Corp. Jan. 24, 1961. Canadian 613,269.

Metal & Mineral Processing

Method for controlling the amount of magnetic iron-oxide-ore concentrate being fed to a balling drum independent of its feeding characteristics, while simultaneously feeding in a predetermined weight of starch, bentonite or other binder so as to achieve the desired ore-binder ratio. A. S. Henderson, C. D. Cross and J. R. Riede, assigned to Reserve Mining Co. Jan. 3, 1961. Canadian 611,949.

In the removal of sodium carbonate and organic sodium compounds from Bayer-process caustic aluminate liquors, the spent liquor is evaporated, whereby the sodium compounds are precipitated as a gelatinous mass, which is separated from the liquor by continuous centrifuging. J. L. Porter, assigned to Kaiser Aluminum & Chemical Corp. Jan. 3, 1961. Canadian 611,698.

In a combination electrostatic-fractional crystallization process for recovering a commercial sylvite product from clayey sylvinite ore, the ore is heated, caused to accept an electric charge, and passed through a heated electrostatic field to produce a slimes-containing sylvite concentrate. This concentrate is treated with a brine that dissolves the sylvite. The slimes and other insolubles are separated and discarded, and the purified solution treated to precipitate the sylvite. I. M. LeBaron, assigned to International Minerals & Chemical Corp. Jan. 3, 1961. Canadian 612,008.

In the extraction of kainite from kainite minerals, the ground ore is pulped in a hard salt liquor using straight-chained primary amines or salts thereof to reduce consumption of long-chained primary amines, and the pulp subjected to froth flotation. A. Singewald, assigned to Wintershall A.G. Jan. 10, 1961. Canadian 612,295.

In an improved Bayer process for total extraction of caustic soluble alumina from bauxite ores or other materials containing monohydrate alumina, the extraction is accomplished in a single digest and with low heat demand. D. J. Donaldson, assigned to Kaiser Aluminum & Chemical Corp. Jan. 10, 1961. Canadian 612,353.

Design for a vortex chamber for concentrating mineral values, particularly iron ore values occurring in or associated with silica or silicates, wherein excessive turbulence is avoided and a good yield of concentrate obtained. C. L. Duesling, assigned to Ferros Metals Research Co. Ltd. Jan. 17, 1961. Canadian 612,795.

Design for and method of operating a centrifugal wet screen for classifying mineral particles, e. g. copper-nickel values associated with iron and siliceous gangue materials. Particles are separated into concentric layers of different density ranges through the action of a free vortex of carrier fluid spinning helically, and the layers are intercepted by a system of concentric sleeves. Z. Vane. Jan. 24, 1961. Canadian 613,014.

Design for an ore briquetting roller press having easily accessible, readily replaceable rollers. J. B. Decker and H. Meder, assigned to Kloeckner-Humboldt-Deutz A.G. Jan. 24, 1961. Canadian 613,161.

Copies of Canadian patents can be obtained by writing to Commissioner of Patents, Patent & Copyright Office, No. 8 Bldg., Carling Ave., Ottawa.

Deep-bed apparatus and method for dissolving halite obtained as a byproduct of the processing of sylvinite ore, and for carrying clay slimes off with the salt brine to a tailings disposal area. W. P. Wilson, assigned to U.S. Borax & Chemical Co. Jan. 24, 1961. Canadian 613,271.

In a method for roasting hematite or other natural nonmagnetic iron ores to permit subsequent magnetic concentration thereof, the ore is crushed to pass 20 mesh, fed at a controlled rate into a reducing flame at a temperature of 1800-2000° F, and flash-roasted for 1-4 sec to accomplish at least partial or surface conversion of the iron to magnetic form. P. E. Cavanagh, assigned to Ontario Research Foundation. Jan. 24, 1961. Canadian 613,353.

Mr. North is patent consultant, Washington, D.C.

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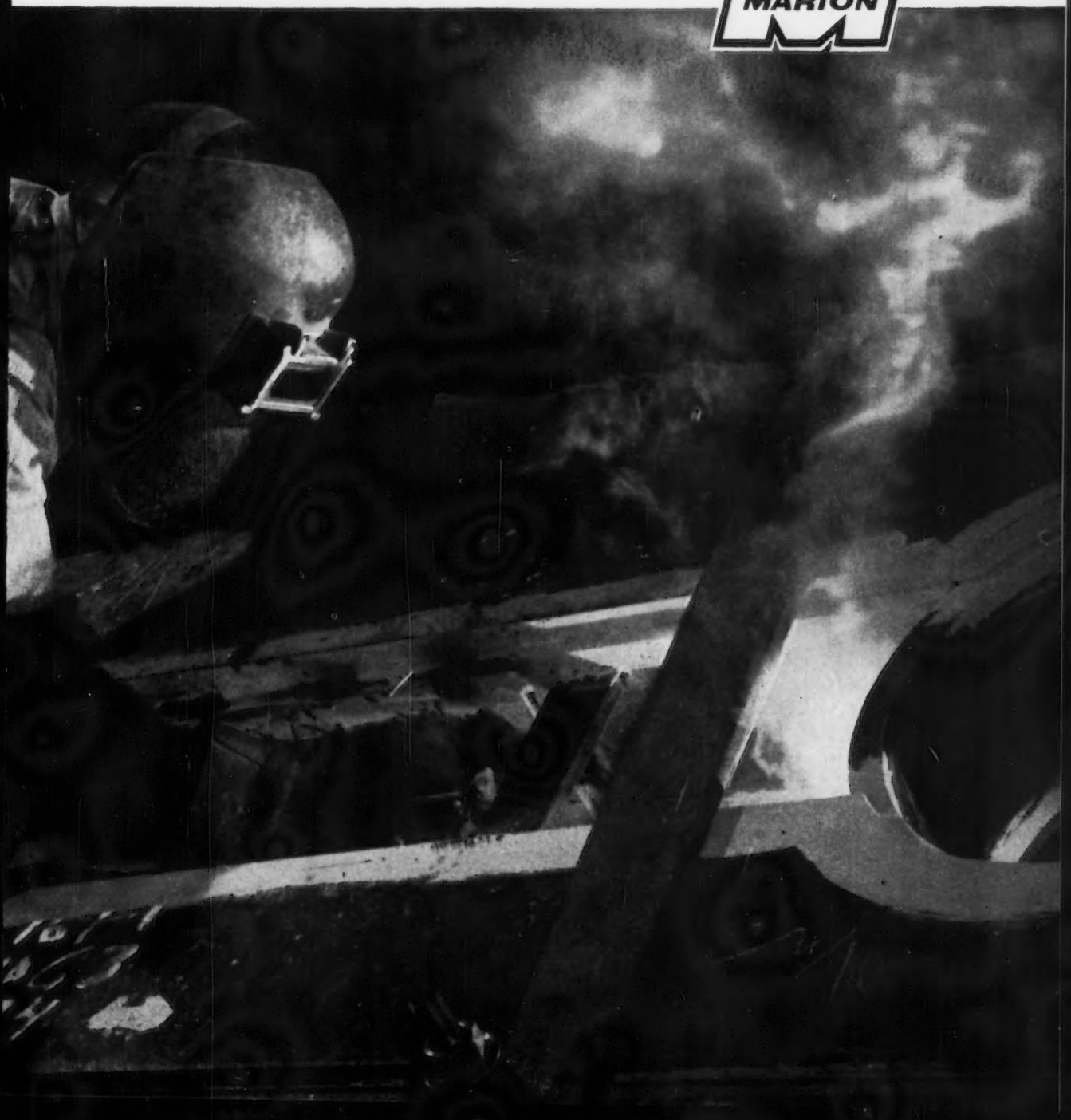
Ever hear of a "hydrogen embrittled" weld? It happens when the welding materials being used do not eliminate a sufficient percent of molecular hydrogen from the weld metal. As the weld cools the trapped hydrogen forms pressure pockets and—crack—the weld's finished. Happily, for you and for us, you'll seldom if ever encounter that on a Marion mining machine. Our secret? Start with a low hydrogen electrode . . . that provides the toughest weld deposit available . . . bake at a certain temperature to reduce moisture (H_2O) from the flux coating. Place in a holding oven until just before use. The result? High strength welds that are often stronger than the surrounding metal. Add to that a team of welding technicians who continually check important welds . . . fully automatic welding equipment and positioners custom made to Marion's rigid specifications . . . and that very tangible "pride in product" attitude that pervades our plant and you have one of the most significant answers as to why Marion excavators produce more for less. Marion Power Shovel Company, Marion, Ohio. A Division of Universal Marion Corporation.

MARION



NEW BOOKS

From Theory to Practice in Soil Mechanics. Selection from the writings of Karl Terzaghi, who is credited with having established the new engineering science of soil mechanics. A partial list of subjects includes early geological papers on the subject, early classics, first international conference papers in 1936, fundamental studies of shearing strength, applications to various problems, settlement and bearing capacity, soft ground tunneling, cofferdams, earth dams, and stabilization of landslides. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 425 pp. Price $12.

Thirtieth Annual Addition, The Flotation Index for the Year 1959. Part I consists of an index of selected articles on mineral dressing. Part II is an index of companies or plants described. Published by the Dow Chemical Co., Midland, Mich. 194 pp.

Handbook of Chemistry and Physics. New 42nd Edition covers mathematics, physics and chemistry in a single volume. New and revised tables include diffusion of metals into metals, interplanetary orbits, standard types of stainless steel, atomic weights, trade names of plastics, and nuclear spins. Published by the Chemical Rubber Publishing Co., 2310 Superior Ave., Cleveland 14, Ohio. 3400 pp.

Cost Engineering in the Process Industries. Edited by Cecil Chilton, editor of CHEMICAL ENGINEERING. Major divisions of the text include articles on principles of cost estimation, process equipment costs, non-equipment capital costs, plant costs, manufacturing costs, profitability and economic analysis, and other areas of cost engineering. Published by McGraw-Hill Book Co., Inc. 330 West 42nd St., New York 36, N. Y. 1985 pp. Price $11.

Black Rock, Mining Folklore of the Pennsylvania Dutch, by George Korson. The author brings to light the lore, music, dialect and legends of the Pennsylvania Dutch in the anthracite mining region. Published by Johns Hopkins Press, Homewood, Baltimore 18, Md. 453 pp. Price $7.50.

Bibliography and Index of the Geology and Mineral Resources of Washington, 1937-1956, by William Reichert. This comprehensive publication covers indexing by author, mineral commodity and area. Published as Bulletin No. 46 by the State of Washington, Division of Mines and Geology. For sale by the Department of Conservation, Olympia, Wash. 721 pp. Price $2.

McGraw-Hill Encyclopedia of Science and Technology. The 15-volume encyclopedia covers all fields of science including life science, physical science, earth science and engineering. Published by the McGraw-Hill Publishing Co., 330 West 42nd St., New York 36, N. Y. Price $175.

The Copper Industry of Arizona. Part I covers the physical properties of copper, history of the copper industry in 1958 and 1959, and U.S. and world statistics for the copper industry. Part II reviews the statistical position of copper in Arizona, including a break-down of production by large and small producers, not only for copper but for all metals and minerals. Copies are available from the Arizona Dept. of Mineral Resources, Minerals Building, Fairgrounds, Phoenix, Ariz.

Waste Treatment, Proceedings of the Symposium on the Treatment of Waste Waters. Edited by Peter C. Isaac. The volume includes discussion of treatment of organic and inorganic pollutants in water. Available at Pergamon Press, Inc., 122 E. 55th St., New York 22, N.Y., and Pergamon Press Ltd., 4 Fitzroy Square, London W. 1, England. 477 pp. Price $15.

BOOKS presented on this page may be obtained directly from the publisher mentioned in each case. E&MJ does not sell books.

Inventory of Washington Minerals, Part I. Nonmetallic Minerals, Second Edition, by Grant M. Valentine, revised by Marshall T. Hunting. Vol. 1 contains the text listing of nonmetallic mineral occurrences in the State of Washington, with property locations by county. Vol 2 contains maps of the State of Washington with an overlay in color to designate known and reported occurrences of various nonmetallic minerals. Published by the State of Washington, Dept. of Conservation, Div. of Mines and Geology. For sale by the Dept. of Conservation, Olympia, Wash. Vol. 1, 175 pp. Vol. 2, 39 maps. Price for the set, $3.

Tungsten Mines of Colorado, by Harrison S. Cobb. Information in this report includes: name of each property, location, owner, brief description of the workings, ore occurrences, potential, last operator, and map sources. Prepared for and published by the State of Colorado Metal Mining Fund Board. 78 pp.

Study of Two Idaho Thorite Deposits, by Joseph Newton, Denis LeMoine, C. N. Adams, A. L. Anderson and J. A. Shively. Topics include a general commodity review of thorium; geology of thorite deposits of the Hall Mountain area, Boundary County; gravity beneficiation tests of thorite from Boundary County; geology of thorite rare earths in the Lemii Pass region; beneficiation of low-grade thorite ore from Lemhi County; and a summary of experimental tests on thorite ores. Published by the Idaho Bureau of Mines and Geology, Moscow, Idaho. 53 pp plus 12 fig.

Atlin Map Area, British Columbia, by J. D. Aitken. Published by the Geological Survey of Canada, Department of Mines and Technical Surveys, Ottawa, Canada. 89 pp plus maps. Price $1.

Energy in the American Economy 1850-1975, Its History and Prospects, by Sam H. Schurr and Bruce Netschert assisted by Vera Eliasberg, Joseph Lerner and Hans Landsberg. Published for Resources for the Future, Inc., by the Johns Hopkins Press, Homewood, Baltimore 18, Md. 774 p. Price $12.50.

Economic Progress and Industrial Expansion, 1946-1959, in the Province of Quebec, Canada. This volume carries a profile of development in agriculture, forestry, mining and quarrying, and electric power, and data on wages, salaries and employment. Published by the Bureau of Economic Research, Department of Labor, 5075 Fullum St., Montreal, Quebec. 106 p. Price $1.00.

Exploration for Non-Ferrous Metals, an economic analysis by Lee E. Preston. Subjects covered in the text include operations of major firms, the cost of exploration, results of exploration expenditures, historical perspective of metals exploration, nonferrous metals exploration since World War II, direct government stimulation of metals exploration, and the impact of public policy on metals exploration. Published by Resources for the Future, Inc., 1775 Massachusetts Ave., N. W., Washington 6, D.C. 198 p.

The following publications are for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D.C.:

Methods and Costs of Shaft Sinking in the Coeur d'Alene District, Shoshone County, Idaho. Information Circular 7961 of the U.S. Bureau of Mines, by John McWilliams and Eric Eriksson. 49 pp. Price 25c.

Mining Methods and Costs, Schwartzwalder Uranium Mine, Jefferson County, Colo. Information Circular 7963, USBM, by J. H. Soule. 24 pp. Price 25c.

Chemical Composition as a Guide to the Size of Sandstone-Type Uranium Deposits in the Morrison Formation on the Colorado Plateau. USGS Bulletin 1112-8, by A. T. Miesch, E. M. Shoemaker, W. L. Newman and W. I. Finch. 60 pp. Price 25c.

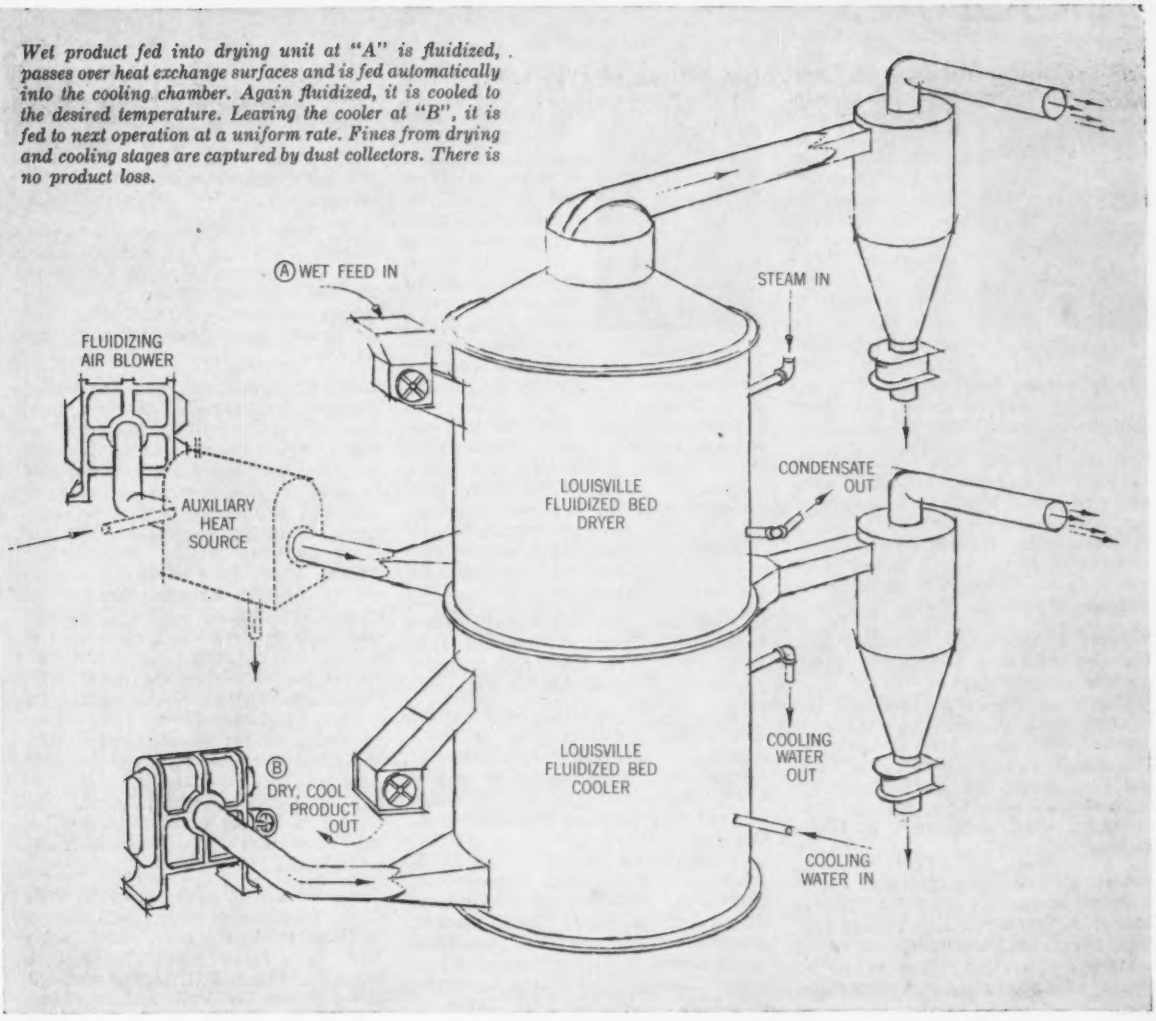
Botanical Prospecting for Uranium in the Deer Flat Area, White Canyon District, San Juan County, Utah. USGS Bulletin 1085-B, by Albert Froelich and Frank Kleinhampl. 33 pp. plus maps. Price 65c.

A Survey of Strategic Graphite. USGS Bulletin 1082-E, by Eugene Cameron and Paul Weis. 120 pp. plus maps. Price $1.25.

Geology of the Knight Peak Area, Grant County, New Mexico. Bulletin 70, by Donald L. Ballman. 39 pp plus 1 map. Price $1.25.

Mineral Resources of Taos County, New Mexico. Bulletin 71, by John H. Schilling. 124 pp. Price $2.50.

Wet product fed into drying unit at "A" is fluidized, passes over heat exchange surfaces and is fed automatically into the cooling chamber. Again fluidized, it is cooled to the desired temperature. Leaving the cooler at "B", it is fed to next operation at a uniform rate. Fines from drying and cooling stages are captured by dust collectors. There is no product loss.



Major break-through in drying and cooling techniques announced by

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A new system for drying and cooling has been perfected by General American Transportation Corporation through their development of Louisville Fluidized Bed* equipment. Two Louisville units, one functioning as a dryer and one as a cooler are coupled vertically to provide a continuous automatic operation.

The system is particularly useful for crystalline chemicals, resins, polyvinyl acetate beads, polyethylene pellets, sugar and similar products having the proper particle size distribution.

Louisville Fluidized Bed equipment offers these advantages:

1. Accurate, instantaneous temperature control
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4. Less cleaning time and labor
5. Less floor space (equipment is vertical)
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Because of their simplicity, Louisville Fluidized Bed dryers and coolers adapt readily to complete automation.

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PERSONALS

P. V. Schneider has been appointed head of a newly created processing equipment department for WEMCO, a division of the Western Machinery Co., San Francisco. In his new position, Schneider will be responsible for sales and development of WEMCO equipment in the mineral, chemical, coal, paper and food processing industries.

Schneider

Schneider was previously field sales manager of the WEMCO division.

Kenneth J. Kutz, most recently with Lakeview Mining Co., Lakeview, Ore., has been named mine superintendent of the Sunshine Mining Co., operations in Northern Idaho. He was formerly associated with Howe Sound at that company's Calera Mining Co. operations in Southern Idaho.

Norman A. Radford, a graduate of the University of Idaho, has accepted a position as geologic engineer with the Trout Mining Co., Philipsburg. Radford has formerly been occupied as exploration engineer in uranium fields in Utah and Washington, and for the past three years had been engaged in geologic engineering and soils engineering for the State of Idaho with headquarters at Coeur d'Alene.

Robert W. Bell, Aurora, Minn., superintendent of open pit mines for Pickands Mather & Co. at the Erie Mining Co., Hoyt Lakes, has been transferred to the company's Cleveland office to be in charge of investigating new properties.

Walter L. Thomte, Aurora, superintendent at the Embarrass mine since 1953, has been promoted to superintendent of mining at Hoyt Lakes for Erie Mining Co.

James E. Schelske, superintendent of the Bennett mine at Keewatin for P.M. & Co., has been transferred to Hoyt Lakes as assistant superintendent of mining.

All three appointments became effective January 1.

Raymond Howard-Goldsmith, manager of operations, Standard Magnetite Co., New York, has been released to fulfill an assignment for United Nations as technical advisor to the Republic of Nigeria in Western Africa.

Raymond Howard-Goldsmith

William B. Agocs, consulting physicist and geophysicist of Elkins Park, Pa., has recently completed an assignment for the United Nations' Special Fund, which included a feasibility exploration study of the mineralized areas of Bolivia.

Roy Ellerman of Elliot Lake, Canada, has been named project manager of Federal-Gas Hills Partners operations in the Gas Hills District of Wyo. where he will direct the operation of the Federal-Gas Hills uranium processing mill, 50 miles east of Riverton, Wyo., as well as mining operations involving several ore bodies controlled by the Partners in the district.

Ellerman

Ellerman succeeds **Raymond G. Lindlof,** who moves to Casper to become project manager of Shirley Basin operations.

Prior to joining Federal-Gas Hills Partners, Ellerman had been employed by Stanleigh Uranium Mining Corp., Ltd., as chief metallurgist and as mill superintendent, assistant mine manager and mine manager.

S. A. Hottman has been named general mine superintendent for the Gas Hills District, having previously held a similar job with Lucky Mc Uranium Co.

John Bley of Nye, Mont., who has the only chrome-producing plant in North America, is the new president of the Mining Assn. of Montana. The general and vice-president of the American Chrome Co., succeeds **Fred Burnett** of Garrison.

Others elected January 11, are **H. F. Johnson** of Butte, first vice-president; **Charles A. McKinley** of Phillipsburg, second vice-president; **Fred Burnett,** chairman of the executive committee; **Victor Szidon** of Trident, vice-chairman; **Stanley Lane** of East Helena, legislative committee chairman; **John Taber** of Darby, vice-chairman; and **W. G. Maloney** of Butte, secretary-manager.

E. H. Crabtree, director of the Colorado School of Mines Foundation at Golden, has been elected to membership on the Board of Directors of Mine and Smelter Supply Co., Denver. It is the first time Mine and Smelter has elected a director from outside the organization.

OBITUARIES

James E. Murray, 84, died March 23, at Butte, Mont. Murray retired from the U.S. Senate this year after more than 25 years service during which he devoted much of his time and energy to the problems of the mining industry.

Born in Canada, Murray became a naturalized U.S. citizen in 1900. After receiving a law degree from New York University, he moved to Butte in 1901 and established a law practice.

In the Senate, Murray was chairman of the Senate Interior Committee, a ranking member of the Senate Democratic Policy Committee and chairman of the Western Conference of Democratic Senators.

A supporter of the New Deal, Murray was a leading champion of legislation to aid labor and small business. He opposed the Taft-Hartley Bill, and fought for its repeal. He was one of the earliest advocates of statehood for Alaska and Hawaii, sponsor of the 1946 Employment Act and a number of national health insurance bills.

R. L. Wahl, 69, retired general superintendent of Michigan Iron Mine for Inland Steel Co., died recently at St. Petersburg, Fla. He began with Inland in 1915 as a mining engineer at Crosby, Minn., and served with the company for more than 40 years.

Lloyd E. Daume, 57, consulting mining engineer, died March 3 in New York. Daume, a graduate of the Michigan College of Mines, spent much of his career in Latin America. From 1935 to 1948 he served as general manager, vice president and director for various tin, antimony, lead-zinc-silver-copper-gold, tin-silver and tin-tungsten properties in Bolivia. From 1948 he served as consulting engineer, managing director and director of various mining companies controlled by Patino and Hochschild in Bolivia, Brazil, South Africa, South West Africa, Southern Rhodesia, Tanganyika, Cameroons, Kenya and Ouhbanghi.

Daume was a member of: The Institute of Mining and Metallurgy, London; Mining and Metallurgical Society of America; American Institute of Mining, Metallurgical and Petroleum Engineers; The Geological Society of South Africa; Instituto Boliviano de Ingenieros de Minas y Geologos.

Kuo-ching Li, 69, chairman of the Wah Chang Corp. and a leading authority on Tungsten, died of a heart attack in his New York office March 7. Born in Changsha, China, K.C. Li was educated at the Hunan Technical Institute, China, and the Royal School of Mines, London. In 1916 Li came to the U.S. to establish a Wah Chang office in New York. He became a citizen in 1948.

Mr. Li is said to have discovered the first Tungsten deposits in China, and in 1915 made the first shipment of Chinese wolfram ore to this country. Li served as advisor to the Allied and British Governments during World War I, and as advisor on tungsten to the U.S. Government during World War II. Early in World War II, Wah Chang was the principal source of tungsten then available to the U.S. and her allies. Today the firm produces molybdenum, columbium, tantalum, tin, zirconium as well as tungsten, and in addition to its worldwide affiliates and agents, Wah Chang operates its own plants in Glen Cove, N.Y.; Fairlawn, N.J.; Texas City, Texas; Albany, Ore.; Huntsville, Ala.

Formerly a director of Central Bank of China and an advisor to the Chinese Embassy in Washington, Li was a delegate to the Bretton Woods monetary conference of 1944. In addition to Mr. Li's many civic and philanthropic activities, he was a member of a number of professional societies, and the founder of the K. C. Li Medal and Prize of Columbia University in the sciences of Tungsten.

NACO ALLOY BALLS

through closer metallurgical control

ROCKWELL	BRINELL
63	710
61	670
59	638
57	601
55	555
53	534
51	495
49	477
47	444
45	429

1½ 1⅛ ¾ ⅜

Distance from surface—inches

tumble per-ton grinding *costs*

Through precise laboratory controls of the elements in steel making — from spectrographic analysis through final heat treating — Naco Grinding Balls possess the correct structure and hardness for maximum impact absorption and wearing qualities. Structurally, Naco Grinding Balls have a grain akin to tool steel — tough, hard and rugged. Laboratory tests show remarkable uniformity in solidity and controlled hardness holding to desired depth. Every day more mill operators are tumbling to the cost-saving advantages of Naco Grinding Balls.

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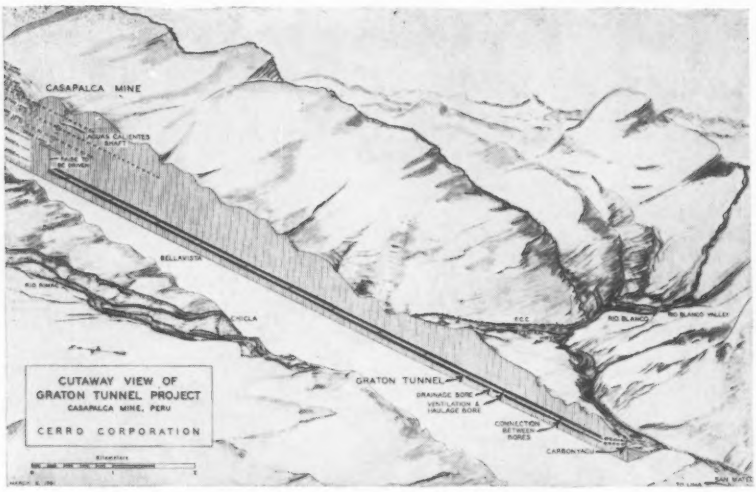


THE CASAPALCA MINE is beginning a five-year project to drain off hot water and improve ventilation at lower depths of the mine. Extensive lead, zinc and silver ores will be mined to an additional 1300 ft after the project is completed.

Cerro Will Drive $8.4-Million Tunnel in Peru

A PAIR of tunnels, seven miles long, are being driven by Cerro de Pasco Corp., subsidiary of Cerro Corp. at the Casapalca mine in Peru to drain off hot underground water and to improve ventilation for a major opening of lower depths.

The Casapalca, which is now being mined roughly at a depth of 2600 ft from the surface, will—after the drainage and ventilation tunnels are driven—mine in excess of 1300 ft of additional workings. Extensive lead, zinc and silver deposits below the present workings have been inaccessible because of flooding and high temperatures.

The Graton tunnel, named after a Cerro director who has long advocated the project, will consist of two parallel drives, 30 to 60 ft apart and about 10 ft in diameter. One bore will carry off the water and the other will provide cool air. The latter will also be used as a haulage tunnel during driving operations. The tunnels will be driven from the portal site on the Rimac River Valley to a point some 700 m below the mine's 2700 level. A raise will finally be driven to the working.

Total cost of the tunnel project, and other contemplated work, is estimated at $8.4-million.

AEC Sets Up Contracts for Uravan Belt Mines

THE AEC has arranged a special program to insure the continued and substantial production of uranium and vanadium from the Uravan Mineral belt in western Colorado, southeastern Utah and northwestern New Mexico.

The "historical basis" program will provide for allocation of the metals based on some sort of an average rate of ore delivery to the mill that is related to production rates and grade of ore produced in the 1956 to 1960 period. This arrangement is necessary because of the "irregular deposits" of the metals, and because it has not been customary on the Uravan Belt to carry out extensive reserve development or exploration ahead of mining.

The figures that the AEC decides on under the new "historical basis" program will apply to specific ore deposits, and no operator will be free to shift allocations to other claims or make new arrangements if the ore doesn't materialize. Also, if a major orebody is discovered while the operator is fulfilling the "historical base" rate in the 1962-1966 period, no extra production of metals will be assigned.

Allan E. Jones, general manager of AEC's operations office at Grand Junction, Colo., said that mill contracts would be completed for the Rifle and Uravan, Colo. concentrators of Union Carbide Nuclear Corp., and for the Durango mill of Vanadium Corp. of America by April 1, 1961. After these mills are assigned concentrate contracts and operating rates, the Commission will then make an "historical basis" determination for the mines. AEC has already completed contracting with two smaller uranium-vanadium mills—Climax Uranium Corp. and Kerr McGee Oil Industries Inc., and has assigned purchases based on the reserves owned by these firms. The Commission has also provided for expected rate of production for nearby independent mines.

UTI Plans BeO Output From Utah Ores Before '62

ANOTHER ENTRANT in the field of beryllium producers who claim successful processes for separating and upgrading beryllium ores from the disseminated deposits of the Spor-Topaz Mt. area of Utah is United Technical Industries, of Salt Lake. The company, formerly known as Larsen Industries, is "well ahead in the race" for a successful mill process to liberate the disseminated Be ores from the clayey ground.

Other participants in "the race" include Bruce Odlum's Beryllium Resources Inc., which will use the Van Dornick process to liberate the oxide for sale to Brush Beryllium. The UTI process, according to Vincent A. Duff, president, is "a chemical process," and not a flotation technique, like Van Dornick's.

UTI will complete a 25- to 40-tpd plant at Delta within a few weeks, and begin production of 250- to 500 lb per day of four-nine BeO before the end of the year.

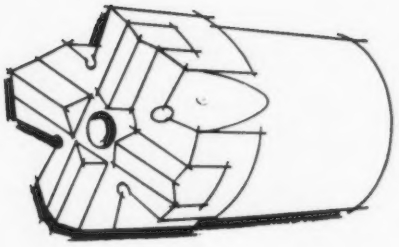
The company, besides entering activity in beryllium, is also a producer of fluorspar in billet form (also from the Spor Mt. area) for the steel industry; is the owner of a fractioning process for rare earths which reportedly shows great promise and which is being applied to rare earths at the company's Salmon, Idaho plant, due in May. The rare earths plant will work on minerals from a large deposit shared with Nuclear Fuels and Rare Metals and can process ores in the neighborhood of 1500 tpm. The fractioning process, invented by Paul Cardon, is said to require one-fifth the time normally consumed in separating rare earths. The mill feed will consist of a 1% Th, 1- to 3% rare earths, ore. The proccss involves ion exchange and solvent extraction.

UTI also specializes in fine comminution of metals for solid-fuel rocket propellants of lithium-aluminum and magnesium-aluminum for the space program and is a manufacturer of a successful rocket engine.

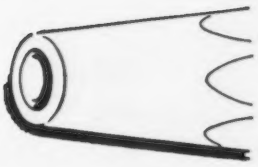
New Mexico Leads In Uranium Mill Output

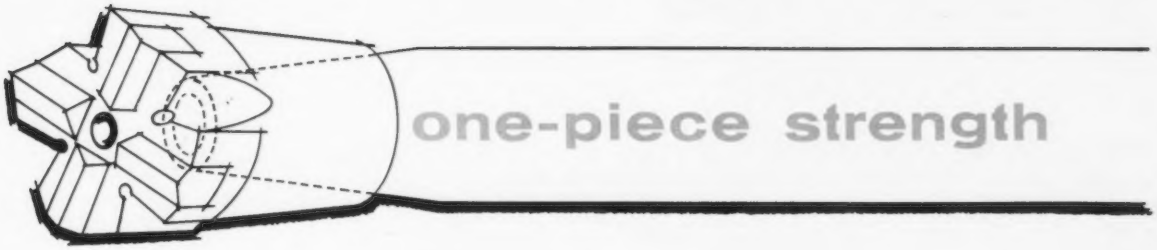
NEW MEXICO'S six uranium mills produced more concentrate in 1960 than the 10 mills operated in the second and third ranking states. Some 15.5-million lb of U_3O_8 was produced by New Mexico, compared to 6.2-million lb from Colorado's seven mills and 6.1-million from Utah's three mills. Wyoming ranked fourth with 5.5-million lb and Arizona, Washington, South Dakota and Oregon combined (with four mills) accounted for 1.9-million lb.

The AEC paid $304,717,000 for the total of 35,273,000 lb purchased.



This removable bit gives





one-piece strength

---cuts air-leg drilling costs

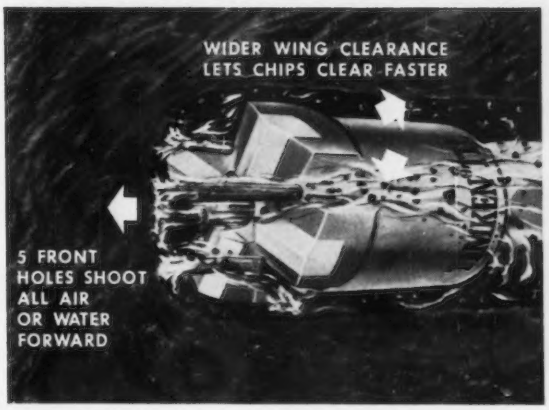
ONE big reason Timken® tapered socket bits save you money is—you don't have to throw away good drill steels after the carbides wear out as you do with intra-sets. Timken bits are removable—yet have one-piece strength. You can keep on using good steels.

And those Timken bits save you even more because only a pocketful are needed for a day's work. Compare that to lugging an armful of intra-sets to the mine face.

Still another reason: with Timken bits you can change bit gauge sizes fast on the same steel. No changing the whole steel.

What's more, *only* the bit itself need go in for resharpening. You don't have to haul the whole steel. And Timken bits give longer gauge wear because there are four cutting edges. Most intra-sets have only two.

Add them all up and see why you'll cut your drilling costs with the TTC—air-leg bit that's tapered for one-piece strength—made of tough, Timken fine alloy steel for longer life. The bit that clears chips faster as the diagram at right shows. Send for free brochure, "Timken Removable Rock Bits". The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.



FASTER CHIP CLEARANCE because five front holes shoot air or water directly against the rock face. And deeper, wider wing clearance lets chips wash back faster.

TIMKEN®

removable rock bits

THREE DELEGATES chat at CMA: Harold A. Weddington, Red Arro gold mine, Silverton; Albert Granger, placer operator at Norwood, and H. W. C. Prommel, geologist of Denver.

ROBERT HENDERSON, of Climax Molybdenum is retiring president of CMA; succeeded by J. F. Brenton.

Colorado Mining Association Asks for Tariffs, Discourages Subsidies

TARIFF PROTECTION for the mining industry, and the development of Government policies to "bring mining to life and secure national safety and well-being for the years ahead" were the highlights of a policy declaration approved at the 64th annual Colorado Mining Assn. meeting.

During the one-day meeting of more than 350 members, various speakers discussed the national and international mining situation, and presented their policy declaration with the statement that the formulation of a national minerals policy "demands prompt consideration."

The association feels that public interest "calls for maximum utilization of the public domain." Its declaration of policy continues, "We reiterate our adherence to the principle of multiple use. . . . Any legislation denying the right to use the public lands to develop mineral resources would be tragic."

The association is of the opinion that foreign spending should take second place to the development and reviving of domestic base metal mines, stating that such developments "would cost but a fraction of many projects of our Government abroad, projects often finished only to be abandoned." The policy statement asks the question, "Why are untold millions spent by our Government to encourage foreign production, in competition with domestic output, when everyone knows the costs of labor are far less abroad than here?"

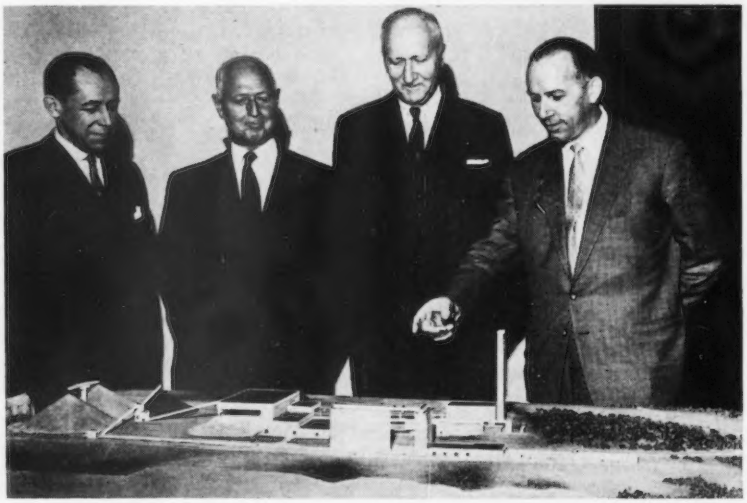
With reference to Government subsidy in the mining industry, the association expresses the attitude that "we have been willing to accept the expediency of subsidy, merely on the theory it would cause less international tension. We now believe the time is here when production, present and future, from American mines must be assured." The association advocates tariff protection "simply because of the difference in costs between domestic and foreign mining."

Cerro Corp. and Newmont Announce Joint $64-Million Cement Venture

Cerro Corp. and Newmont Mining Corp. jointly announced plans to construct the largest cement mill on the Atlantic Coast on a site at Ravena, 12 miles south of Albany N.Y. on the Hudson River. Cost will be about $64-million. Initial capacity will be 10-million bbl per year. Directors of both corporations have approved the venture, and subject to final financial arrangements, project construction is expected to start during the next few months.

Diversification of Cerro and Newmont into a new cement project of these proportions came as a surprise to the business world. Queried as to the motives for this shift in activities, company officials said that the object was simply "to make money" and that the Atlantic Coast project appeared to be attractive on a long-range basis.

It meets the following essential requirements for a cement project: (1) Adequate and near-by cement-rock reserves, (2) an efficient processing plant, (3) availability to low-cost transporta-



PLATO MALOZEMOFF (left) president of Newmont, William Moise, financial consultant, and Robert Koenig, president of Cerro Corp., study plant details pointed out by Dr. Bernard Ulrich, authority on cement mill design and president designate for the new Atlantic Cement Co. Inc.

Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...

Profitability?

Faced with the decision to expand your plant facilities, you should first determine whether all elements combine to form a pattern of future profitability. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. The studies and evaluations furnished by KE Pre-Engineering represent only one phase of total KE services. Kaiser Engineers is an experienced designer and builder of all types of facilities for the Minerals industry. From Pre-Engineering through design and construction, Kaiser Engineers provides complete one-company service and ingenuity based on years of experience.

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NEEDS NO RESHARPENING

Western Rock Bit design precludes the reverse taper dullness common to conventional bits and gives an effective drilling life, lasting far beyond the point where coventional bits must be withdrawn from service for resharpening.

Western Rock Bit's exclusive design accomplishes great drilling economies

fast drilling-long life
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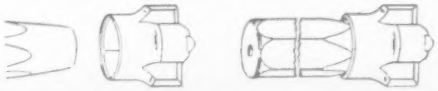

WESTERN ROCK BIT
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Atlantic Coast (*Continued*)

tion, and (4) a good long-range market for the product. Reserves of a good grade of cement rock situated only three-quarters of a mile from the plant are adequate to last more than 100 years. Over 2000 acres are under option for the quarry, plant site and loading facilities.

Dr. Bernard Ulrich, famed Swiss design engineer, said that the plant will be among the most efficient designed to date. Dr. Ulrich will head the project. Although most of the output of the plant will be loaded in deep-water vessels at docks on the Hudson via a 7000-ft conveyor, products of the plant can readily be shipped by truck on two adjacent highways, and the New York Central which passes by the property. Water transportation will permit shipment of cement output to Atlantic Coast ports from Maine to the Gulf.

John W. Jacobsen, director of engineering, said that initial capacity of the plant will be 10-million bbl per year but that the design was flexible enough to permit enlargement to 15- to 20-million bbl capacity in the future.

Sweden Will Open Four New Iron Ore Fields

AN INITIAL expenditure of 5.6-million krona (about $1.1-million) is planned by the Swedish government's LKAB board to open up four new iron ore fields near Svappavaara. Production is expected in 1965, after completion of a new railroad from Kiruna to the mine site. Initial production from the first of the four deposits has been set at 500,000 tpy, with provision for eventual expansion to plus-3-million tpy by 1967 or 1968. The ore is described as one-half plus 50% Fe, with minor amounts of phosphorus, and the remainder of lower grades. The mines are expected to be open pit, and plans are being studied for a pelletizing plant.

IMC, CalChem and Parry Join in Indian Project

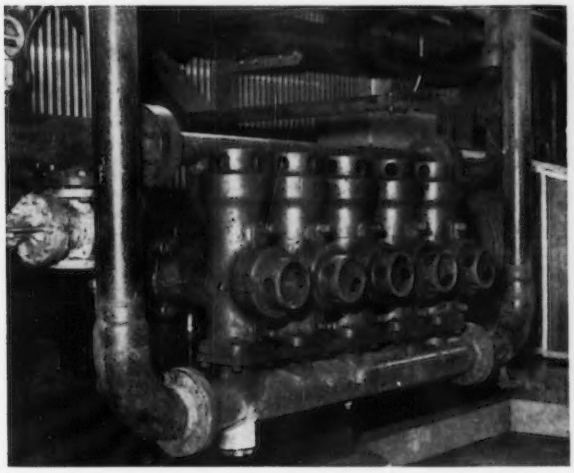
INTERNATIONAL Minerals & Chemical Corp. and California Chemical Co., with the E. I. D. Parry group, of India, have been granted a license by the Indian government to construct a proposed $51-million fertilizer plant on the east coast of India.

The plant would produce about 350,000 tons of chemical fertilizers annually, according to an announcement by the American companies in the joint venture.

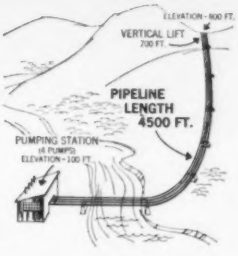
Teams of IMC agronomists, economists, and engineers have visited India to study the situation in the past 18 months.

Present plans call for construction of the Indian plant in the port city of Visag, near a Caltex oil refinery which will supply some of the major ingredients.

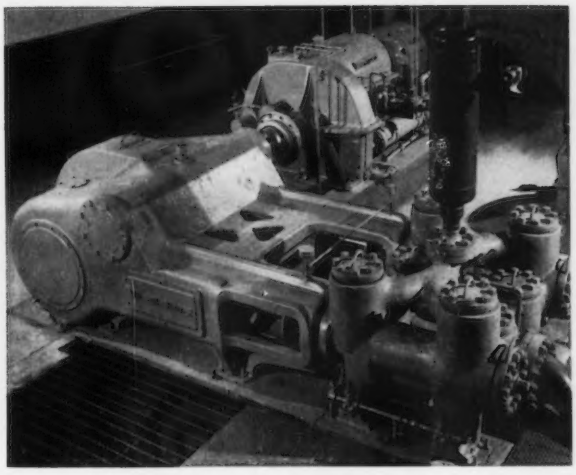
This mark tells you a product is made of modern, dependable Steel.



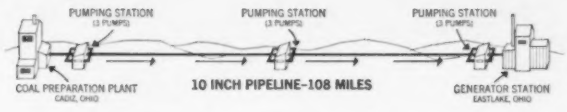
This short line carries waste materials in slurry form from a coal preparation plant to a disposal area—a distance of 4,500 ft. and a rise of 700 ft. Four Wilson-Snyder Quintuplex Power Pumps do the job.



Short Haul . . .



It's 108 miles between terminals on this line that carries coal in slurry form from Cadiz, Ohio to Eastlake, Ohio. Nine Wilson-Snyder Duplex Power Pumps do the moving. Line is operated by Hanna Coal Co. (Div. of Consolidation Coal Co.)


PUMPING STATION (3 PUMPS)
PUMPING STATION (3 PUMPS)
PUMPING STATION (3 PUMPS)
COAL PREPARATION PLANT CADIZ, OHIO
10 INCH PIPELINE–108 MILES
GENERATOR STATION EASTLAKE, OHIO

Long Haul . . .

Use Wilson-Snyder Pumps for high pressure slurry handling

The selection of the above installations emphasizes one important fact: Wilson-Snyder pumps are operating successfully and efficiently in both the long and short haul situations illustrated by these particular installations. It is important to know that Wilson-Snyder reciprocating-type pumps will perform successfully in applications involving the pumping of high pressure fluid-solids that cannot be handled by single-stage centrifugal pumps.

Wilson-Snyder pumps are available in a wide range of displacements, working pressures, and fluid-end designs and materials. Behind the successful performance of Wilson-Snyder pumps is the background and experience of Wilson-Snyder engineers, who are fully aware of the unique problems associated with each individual slurry pumping application. During the early planning stages of your slurry pumping installation, let Wilson-Snyder lend their experience and background to your engineers to be sure of selecting the most suitable pumping equipment . . . this means Wilson-Snyder. *USS is a registered trademark*

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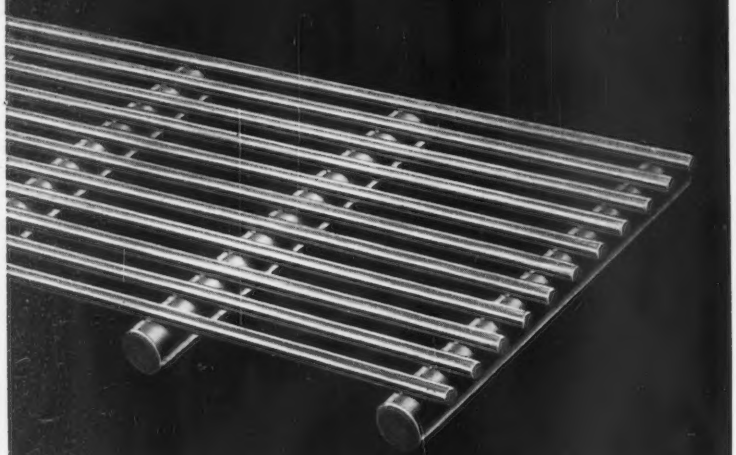

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Bethlehem Copper, B.C. Signs $5.5-Million Plan

BETHLEHEM COPPER CORP. LTD. and Sumitomo Metal Mining Co. of Japan have signed an agreement which will make available $5.5-million to put the Highland Valley mine in production by 1962.

Initial production rate will be 3000 tpd of ore for three years, to be increased to 5000.

Working capital of $1-million will be bank funds.

Mining capital of $1.5-million will be saved by contracting the open pit operation.

Agreement must be ratified by the Japanese Government May 31, first money in hand by July 2, and production should start in 1962.

Comalco Aluminium Adds To Anzac Aluminum Plan

AN ADDITIONAL STRING to the network which will eventually create the vast Comalco Aluminum project in Australia and New Zealand was placed last month with the acquisition of Austral Bronze Co., in Australia.

Kaiser Aluminum and Consolidated Zinc, joint owners of Comalco, are preparing to mine bauxite at Weipa, in Queensland and refine it at Invercargill, using power from a huge power complex which the firm will build in New Zealand.

"Project Gnome" Now Set For December 1961

PROJECT GNOME—AEC's nuclear detonation experiment program at Carlsbad, N.M.—is still in the "getting ready" stage, and is 18 weeks behind schedule. Unusually heavy rainfall, a crane breakdown, delayed delivery of materials, two strikes, and underground water have slowed the Government program which will determine the effects of a five kiloton nuclear explosion on a salt structure —fired at a depth of 1200 ft.

There is water in the Culebra formation from 498 ft to 532 ft. Sealing was by chemical and cement injection followed by cement grout. Some 6500 cu ft of materials were moved and 8800 ft drilled during water sealing operations, which required eight instead of the anticipated four weeks.

Shaft tunneling should begin in early June at a rate of 150 ft per week. One interesting change in the original plan has been proposed. Rather than construct a straight tunnel ending in a hook to the shot chamber, scientists may construct a semicircular curve about one-tenth down the straight stretch in order to protect further the scientific instrumentation and the tunnel against blast.

The "ready" date for Project Gnome is now December 1961.

Photographed on the job with Pioneer Construction Co. at Treverton, Pennsylvania

Pioneer Construction Tests All Major Wire Ropes — Picks Yellow Strand "POWERSTEEL" and Flattened Strand

The test that proves Yellow Strand best is **comparison.** For over-burden removal at coal stripping job on Treverton Mountain, Pioneer Construction Co. of Shamokin, Pa. made its own test. Flattened Strand on the hoist and "POWERSTEEL" on the drag line were pitted against other premium ropes. Result? – longer operating hours with Yellow Strand. Put "POWERSTEEL" or Flattened Strand to your test. In the long run, greater strength, extra durability and more resistance to corrosion and damage make these wire ropes **best** for economy. Contact your Yellow Strand distributor or write direct for full particulars.

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"POWERSTEEL"

BRODERICK & BASCOM ROPE CO.
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International Nickel Selected Marcy Mills for its new Levack Plant

Inco's new 6000 ton per day Levack Mill, in the Sudbury district of Canada, features extensive use of automatic and remote controls designed for maximum efficiency to offset rising costs.
The company states that: "The experience gained from its Copper Cliff and Creighton mills, operating since 1930 and 1951 respectively, proved of great value in designing the Levack Mill." Marcy Mills are used at both Copper Cliff and Creighton.

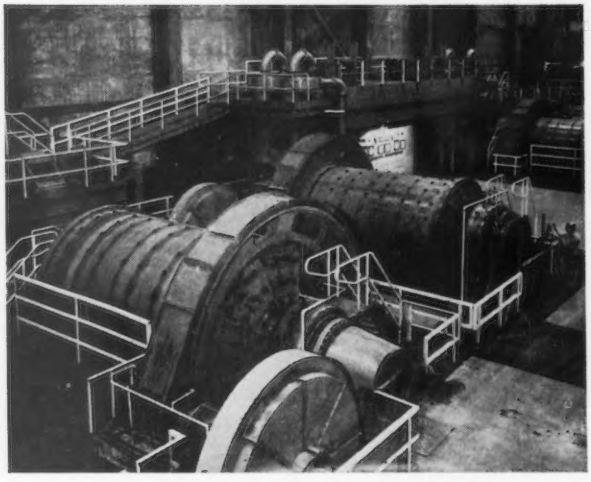
INCO HAS PURCHASED A TOTAL OF 61 MARCY MILLS

International Nickel Company of Canada, Ltd., world's largest producer of nickel, has purchased a total of 61 Marcy Mills including the four at Levack.

TYPICAL EXAMPLE OF MINE AND SMELTER'S WORLDWIDE SERVICE

Canadian Vickers, Ltd., Montreal, Mine and Smelter's sales agent and licensed manufacturer for Marcy Mills in Canada, in cooperation with International Nickel and Mine and Smelter, manufactured and serviced the Marcy Mills for Levack.

PHOTO COURTESY INTERNATIONAL NICKEL



LEVACK MILL. Photo shows one of the two grinding sections. Each section includes one 10' x 15' Marcy Rod Mill and one 10' x 14' Marcy Ball Mill. Central instrument panel controls entire grinding operation.

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Manufacturing Division

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Sales Agents in Mexico, Peru, Chile, Philippine Islands, Japan, New York City (for Continental Europe) and in principal cities of the United States.

Venezuelan Iron Mines Receive Second Tax Bite

BETHLEHEM STEEL CO.'S Venezuelan subsidiary, Iron Mines Company of Venezuela, has had an additional $2.8-million in taxes levied on its operations by the government, bringing the total bite to $24.2-million (see March 1961, p 19).

Iron Mines' first years of operation in Venezuela, 1951 and 1952, were not affected because of a 5-year time limit on tax review. Initial tax claims were entered in 1958.

For the entire 1951-59 period, the Ministry of Mines & Hydrocarbons calculates that the government's tax bite out of the company's net income is now 63%, leaving Iron Mines only 37% of the net income as after-tax profit.

Government revenues from Iron Mines' operations in 1951-59 were $19.8-million before presentation of the tax claims. Now they are upped to $44-million.

Government revenue per metric ton of Fe content of ore sold in the 1951-59 period has been upped from an average $1.57 to $3.48.

Similar claims against Orinoco Mining Co., U.S. Steel subsidiary, are still pending.

Titanium Rocket Case Proves Up in Testing

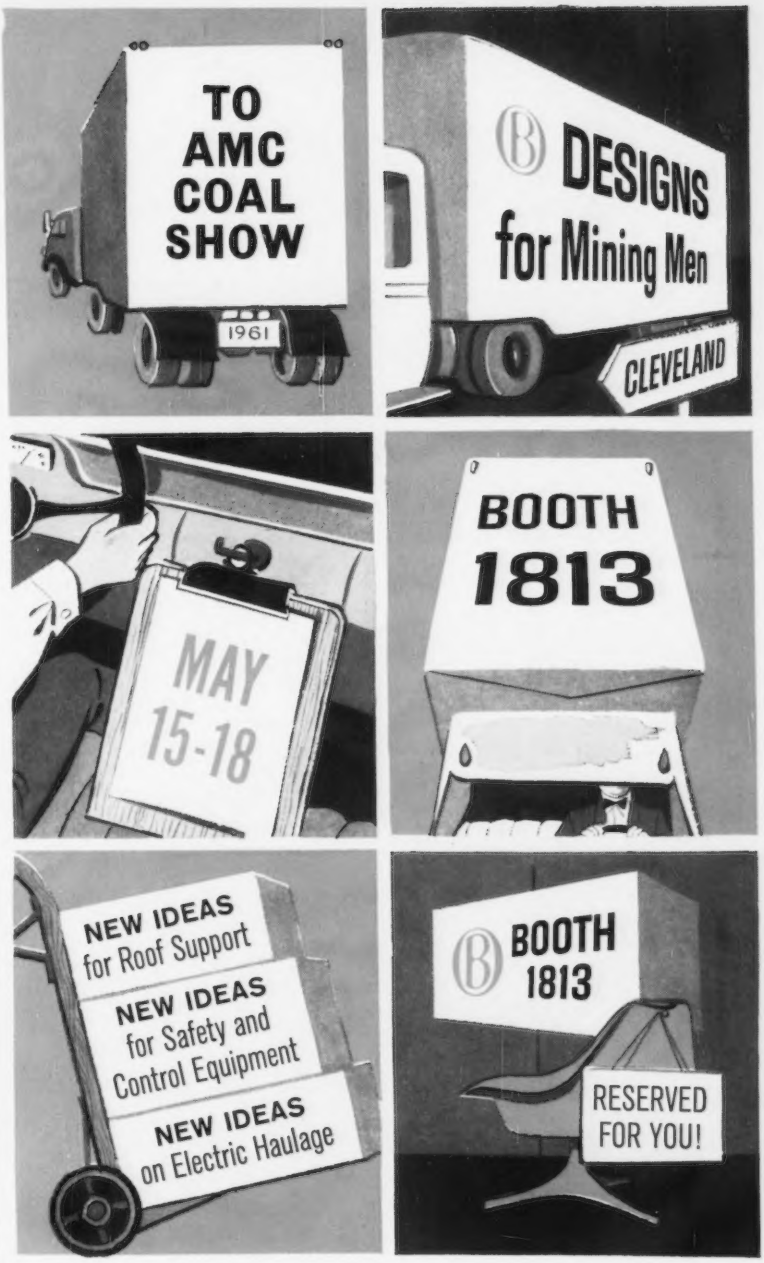
THE U.S. Army Ordnance Missile Command has announced the successful static firing of an improved high-energy solid propellant rocket motor using a lightweight, high strength motor case made of titanium. It is said that the titanium case, almost 30% lighter than steel cases currently in use, made the motor "the highest performance metallic propulsion unit pound-for-pound ever successfully fired in the U.S."

While the titanium weight-saving characteristic is important, the most outstanding property of the metal is its durability. These qualities are of utmost importance to the Army, as missiles and rockets might be stored for months in such widely divergent areas as Alaska and the Panama Canal Zone. In tests of its resistance to corrosive agents, a sub-scale titanium case was unharmed after 60 days of constant exposure to a salt water spray.

Jamshedpur Symposium Studies Light Metals

TO FOCUS ATTENTION on India's need for a faster growth of its light-metals industry, the country's National Metallurgical Laboratory, Jamshedpur, organized and conducted a Symposium on Light Metal Industry in India from Feb. 14 to 17.

Scientists and engineers from India and from the U.S., the U.K., W. Germany, Switzerland, France and Japan contributed 27 papers, which covered a



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Jamshedpur (*Continued*)

range of subjects from Indian light-metal resources to the physical and chemical properties of light-metal alloy systems.

Of interest to mining were "Prospects of Aluminum in India," by P. Dayal, in which a forecast was made that demand for aluminum in the country would treble by 1965-66 from the present 45-50,000 tpy; and "Studies in the Amenability of Kolhapur Bauxite to Bayer's Process," by G. G. Mathad and V. A. Altekar, in which these deposits in southwestern India were reported favorable for Bayer refining at atmospheric pressure. In "Latest Developments in Aluminum Reduction," Paul H. Muller and Roland E. Oehler of Switzerland discussed recent technical refinements in the electrolytic aluminum cell. "Electrolytic Production of Magnesium and Magnesium Alloys," by P. K. Som, P. B. Chakravarti and T. Banerjee, surveyed magnesium resources and extraction methods, and reported experiments in progress at the National Metallurgical Laboratory on dehydration of hydrated magnesium chloride and on electrolytic production of magnesium metal from the dehydrated chloride.

Major Iron Ore Lands Leased by Broken Hill

THE State Government of Australia and Broken Hill Pty., Ltd. have entered into an agreement to establish an integrated iron and steel industry. The major provision of the agreement, announced by Premier Brand, gives BHP a government lease of fifty years for the use of iron ore deposits in Koolyanobbing which contain an estimated 100-million tons of ore.

The company will have renewal rights for successive periods of 21 years.

IN THE U.S.

ALASKA

The Riverside Mine in the Hyder district has shipped 12 tons of concentrates to the smelter at East Helena, Mont. The shipment assayed 74.2% lead, 40.2 oz silver, and 0.60 oz gold, according to reports.

ARIZONA

Mine smelters in the Phoenix vicinity are being blamed for the current air pollution problem which is developing in the Central Arizona basin. The smog, known in Arizona as "smust" because of its composition of smoke and dust, is being attributed to the smelters' sulphur fumes which drift into the basin.

Dust storms, unpaved streets, crop dusting and vehicle exhausts have com-

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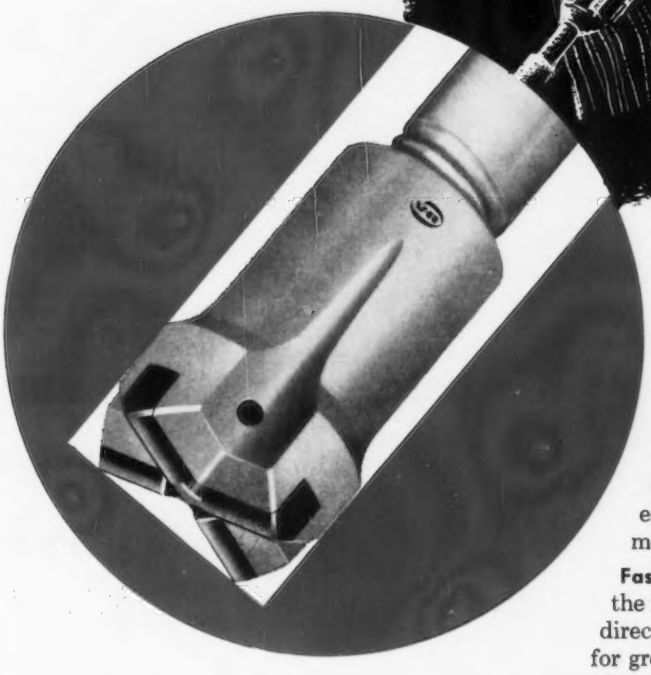

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March 17, 1961

Arizona *(Continued)*

plicated the problem to the extent that Arizona's legislature is considering a house bill to appropriate $35,000 to conduct an air pollution study and recommend a remedy.

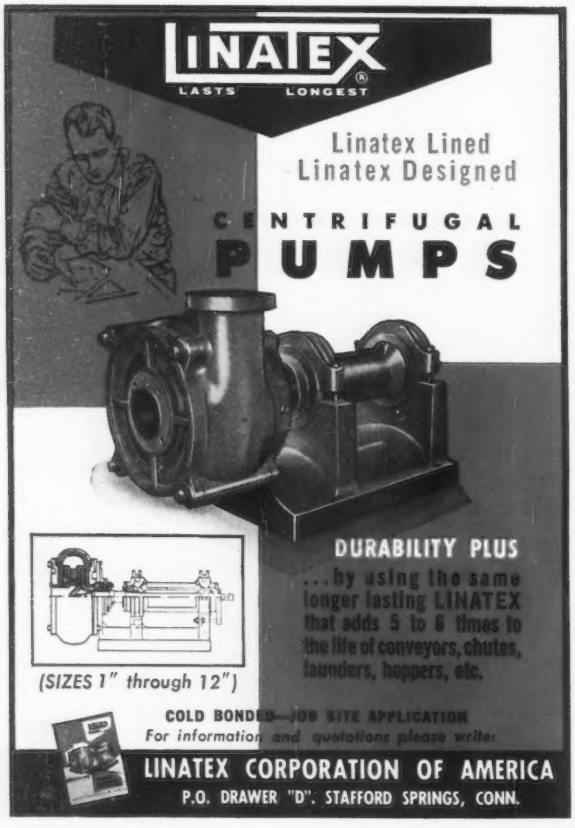
J. F. Knudsen, engineer for Kennecott, which operates a mine at Ray and a smelter at Hayden, took issue with accusations against his industry. Knudsen said air pollution tests two years ago at Ray-Hayden revealed negligible air pollution from their plant, and further stated that 97% of Hayden's exhaust was eliminated by special stack equipment.

COLORADO

USBM has expressed interest in acquiring the $1½-million uranium pilot plant at Grand Junction, now owned by the AEC.

The plant was built and operated for AEC by National Lead Co., which perfected a resin-in-pulp process for uranium ore there. The facility has now been declared surplus and AEC has asked other Government agencies if they want the facility. This is preparatory to selling it to the uranium industry on a basis of sealed bid.

Allan E. Jones, general manager of the Grand Junction Operations Office, said that it is probable that the uranium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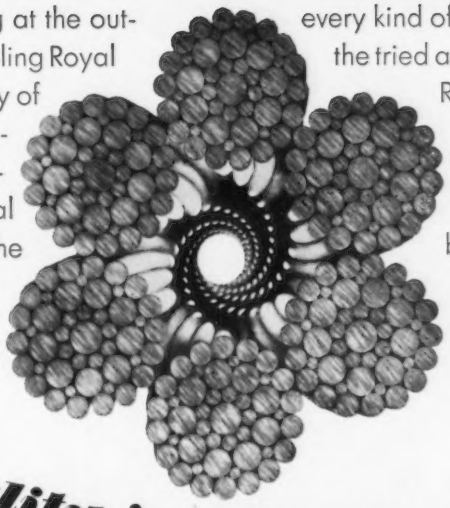

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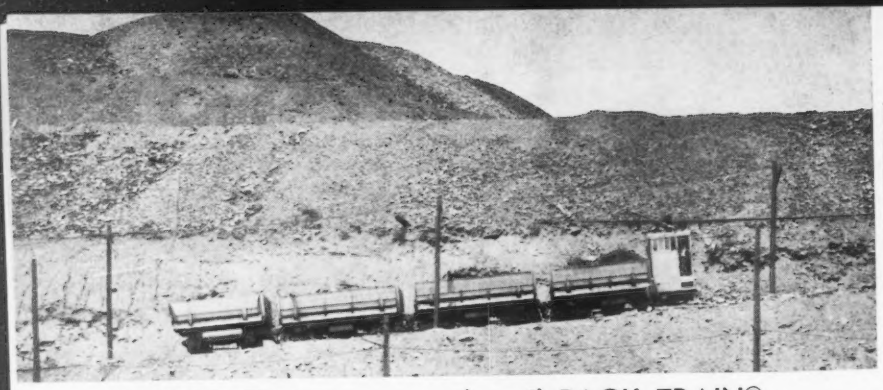

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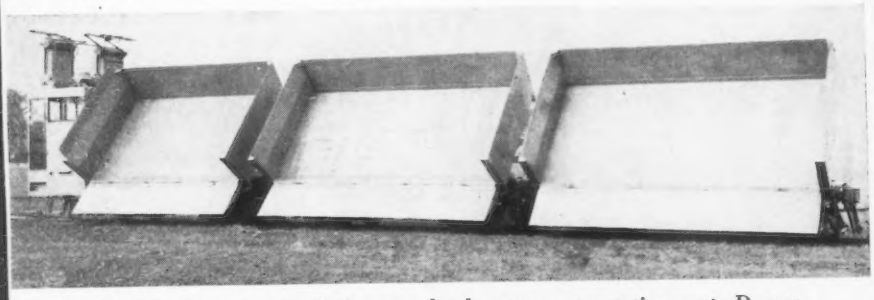

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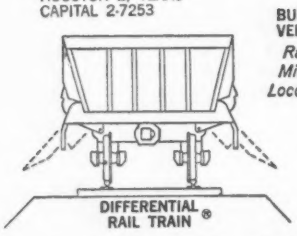

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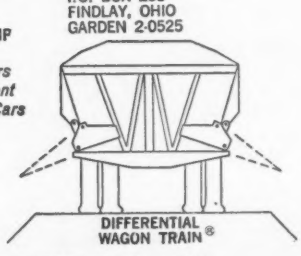

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Colorado (*Continued*)

segments of the multi-million dollar Monticello A-ore mill will be placed up for sealed bid by uranium operators within 30 days.

Non uranium (radioactive) portions of the mill, including certain tools, machinery and supplies could possibly be sold by General Services Administration rather than by AEC, Jones said.

IDAHO

General Mines Corp., Spokane, has announced plans for diamond drill exploration work at property on Little Pine creek near Kellogg. Crews have removed about 30 ft of overburden at the side, located near the Page mine.

New electrical equipment was installed and the air line was rebuilt during the 1960 work season.

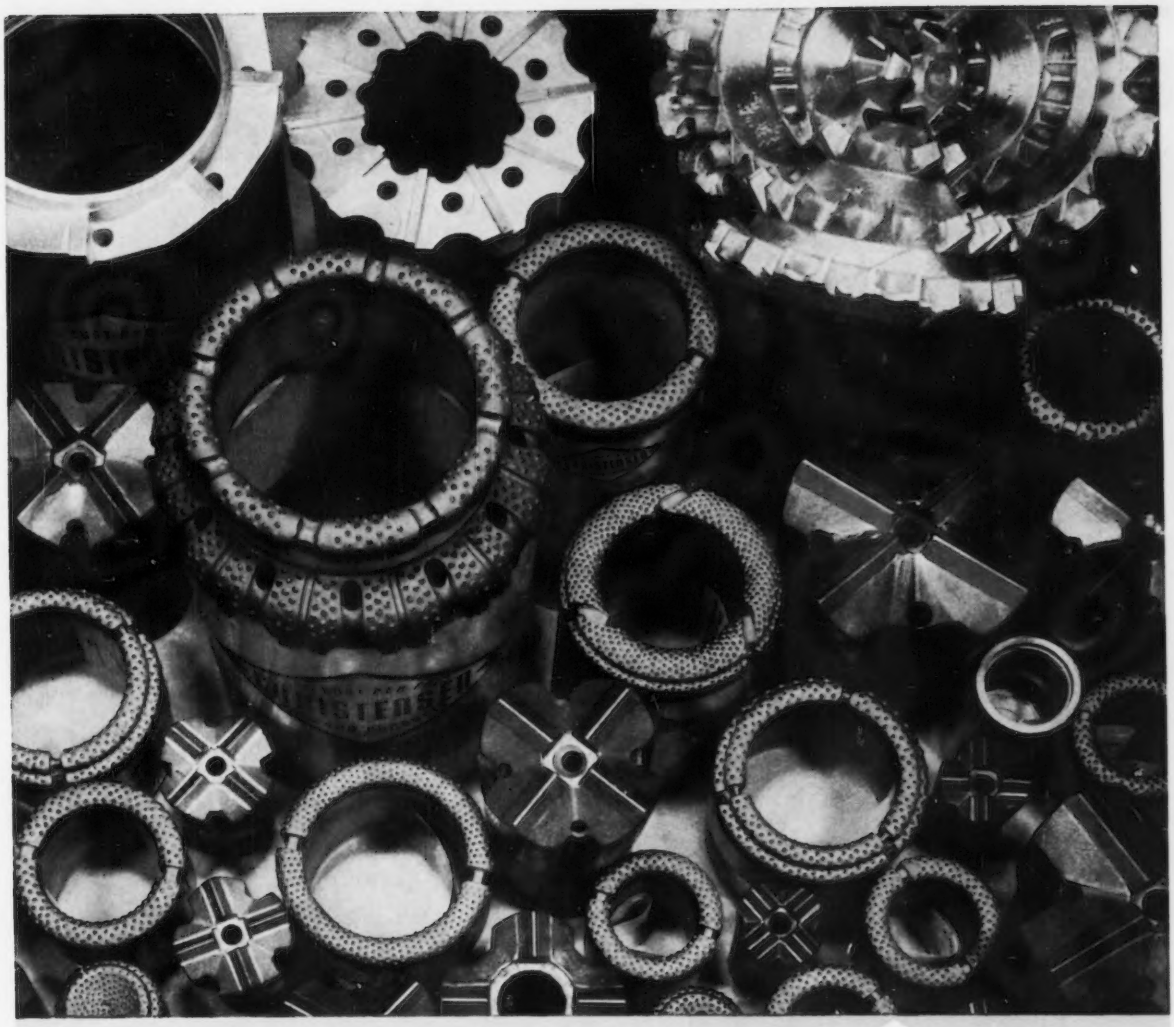
A new corporation, Three Queens Mining Corp., has been organized at Wallace to carry on extensive exploration work this spring at the old Mountain Lion gold property in the gold rush section of Murray, north of Wallace. Spokane interests are financing the undertaking and incorporators of the new firm are Frank Schamel, Murray; L. J. Gugllar, Spokane, and E. F. McCann, Wallace. Schamel has been carrying on hydraulic operations to remove top soil in a section where he reports a promising surface discovery has been made. Extensive diamond drilling will be undertaken at the start of the exploration program.

Robert J. Hundhausen, Spokane mining engineer, L. L. McLean and G. Fansler, also of Spokane, and Clair Wynecoop, Wellpinit, Wash., have taken a lease and purchase option on the Bay Chief lead-silver claims high in the mountains north of Burke, and have announced plans for road construction work and exploration of the claims this summer. The property consists of 11 patented claims and four unpatented claims which extend into Montana and were first located in 1911.

The old Formosa Lead Mining Company, Ltd., which owns three patented claims in the Burke section north of Wallace, has been revived with election of W. W. Witherspoon, William A. Davenport and Allan H. Toole, all of Spokane, as directors. The original corporation's 50-year charter expired in 1957. Preliminary work is under consideration at the claims as soon as snow conditions permit work this spring.

A paper, "World's Silver Supply—Present and Future," was prepared by John Edgar, manager of the Sunshine Mining Co. in Idaho, for presentation at the annual convention of the Canadian Prospectors and Developers Association in Toronto, Ontario, March 6 to 8. The paper was read at the meeting by S. K. Garrett, Sunshine's chief geologist.

Joseph Newton, head of the department of mining and metallurgy at the University of Idaho's college of mines, and J. M. Whiting, assistant professor of min-



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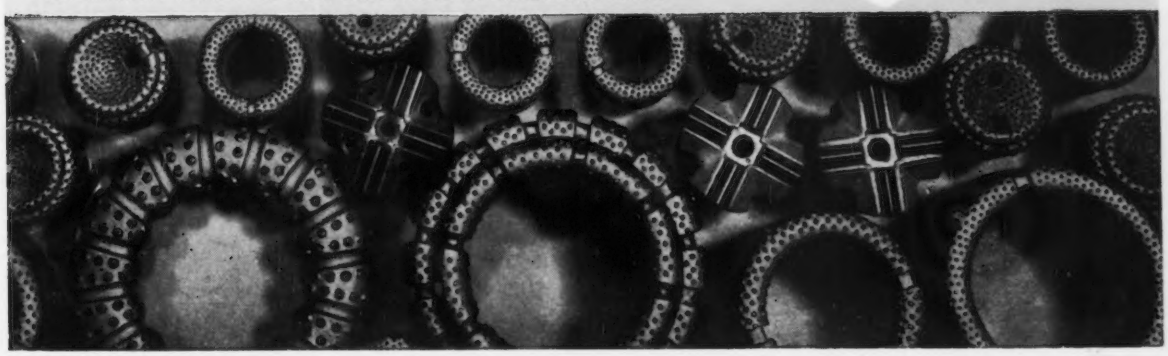

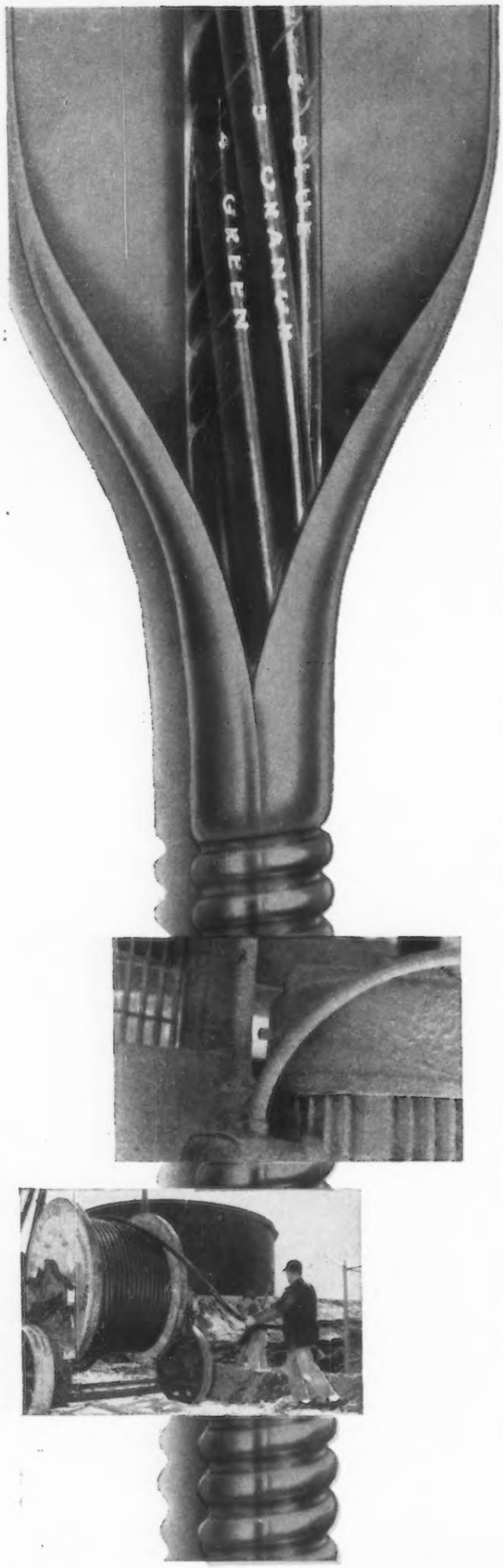

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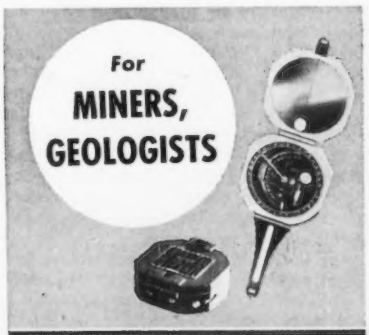
Idaho (*Continued*)

ing engineering, have prepared a paper on Mining Engineering — Dying Profession?" in which they say mining engineering enrollments in U.S. schools have been declining steadily since 1910 and they urge greater interest by the industry as a whole to revive mining engineering as a profession.

Operations of the Galena and Page mines of the American Smelting and Refining Co., in Northern Idaho are back at normal following the seven-month strike against the properties in 1960, and repairs necessitated by the long shutdown have been completed at both properties, according to J. C. Kieffer, northwestern mining manager of the firm. The No. 3 shaft sinking project at the Galena is back in full swing on a three shift per day basis and the average daily advance is considerably better than it was before the strike, Kieffer commented.

"Idaho mineral production took a drastic drop in value during 1960," George D. Fletcher, Idaho state inspector of mines, said in the opening statement of his 1960 report on the mining industry of the state. He attributed the slump to labor troubles in Northern Idaho and the closure of the cobalt-copper property of the Calera Mining Co. in Idaho's Lemhi County.

Golconda Lead Mines carried on no mining operations during 1960 and did not



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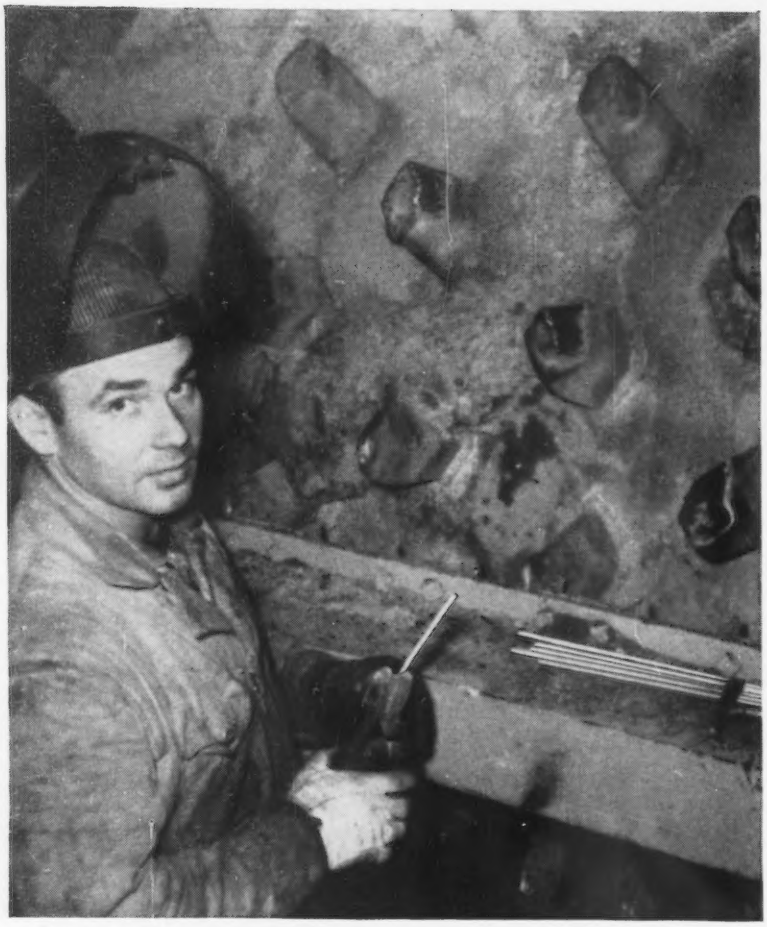

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Idaho (*Continued*)

operate its mill after February of that year, yet had a net income of $92,740 from dividends on investments, the company's annual report issued at Wallace shows. The firm owns 155,000 shares of Lucky Friday Silver-Lead Mining Co. stock and 37,000 shares of Hecla Mining, according to the report. It also states that preliminary steps have been taken toward what may lead to new exploration of Golconda's holdings as well as adjacent properties if and when lead-zinc prices improve sufficiently to warrant such exploration.

Clayton Silver Mines, which operates in South Central Idaho, reports a net of $122,814 on 1960 operations compared with only $78 in the preceding year. The big boost came, the company's report shows, from sale of zinc concentrates produced by the mine in previous years. It operated steadily on a six-day week basis throughout 1960.

The Sidney Mining Co. in its annual report to stockholders says that further exploration is planned at the company's Bayhorse property in Southern Idaho and that diamond drilling work will continue this year on the west end of the company's Nevada-Stewart property in the Pine Creek section of Northern Idaho.

MICHIGAN

The valuation for mining properties in Upper Michigan will be reduced by $13,750,000 for 1961 tax purposes, according to Harry J. Hardenberg, deputy state geologist for the Conservation Department.

He said the cuts would apply to valuations recommended for the Gogebic, Menominee and Marquette ranges, but did not include copper properties, where an additional valuation drop of more than $1-million was announced.

The 1961 valuation of iron mines in Upper Michigan will be $78,040,500, exclusive of beneficiation plants, Hardenberg said. The 1960 amount was $90,611,200, but includes the beneficiation plants.

The Sunday Lake Mine at Wakefield, Mich., was closed indefinitely Feb. 16 by the Lake Superior Mining Division of Pickands, Mather & Co. The mine employed 133 persons.

The firm gave no reason for the shutdown, which followed the layoff of 80 miners at the mine in the month before the closing. Other Gogebic Range mines have laid off about 420 miners recently.

Michigan employment officials said the shutdown would push the unemployment rate in Gogebic County to 16.5% of the work force.

Pickands Mather & Company's Buck mine at Caspian has been ordered to suspend all development work, resulting in the lay-off of 30 to 40 men. The suspension is "due to the national economic situation, and the lack of demand for the Buck high phosphorus type of ore."

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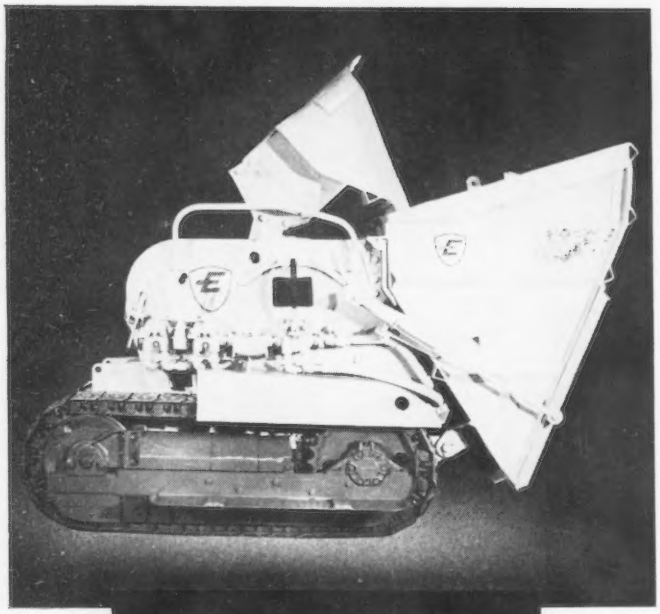

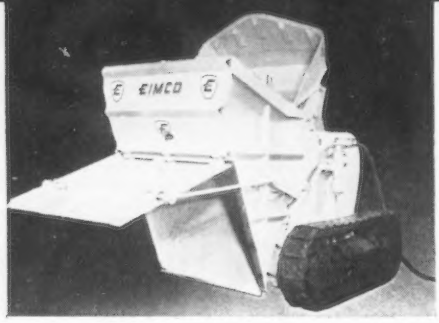

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Michigan (*Continued*)

Cleveland Cliffs Iron Co. produced 61.89% of its total 1960 ore shipments from its Michigan properties where it has long operated large underground mines on the Marquette range. Of its 3,852,182 tons from eight Michigan, Marquette range mines, 1,906,440 tons came from the Mather which has shipped over 1-million tons for the past 12 years. It had its best year in 1955, 2,787,268 tons. Its 1960 tonnage was by far the highest of any of Cliff's 13 producers in Michigan and Minnesota.

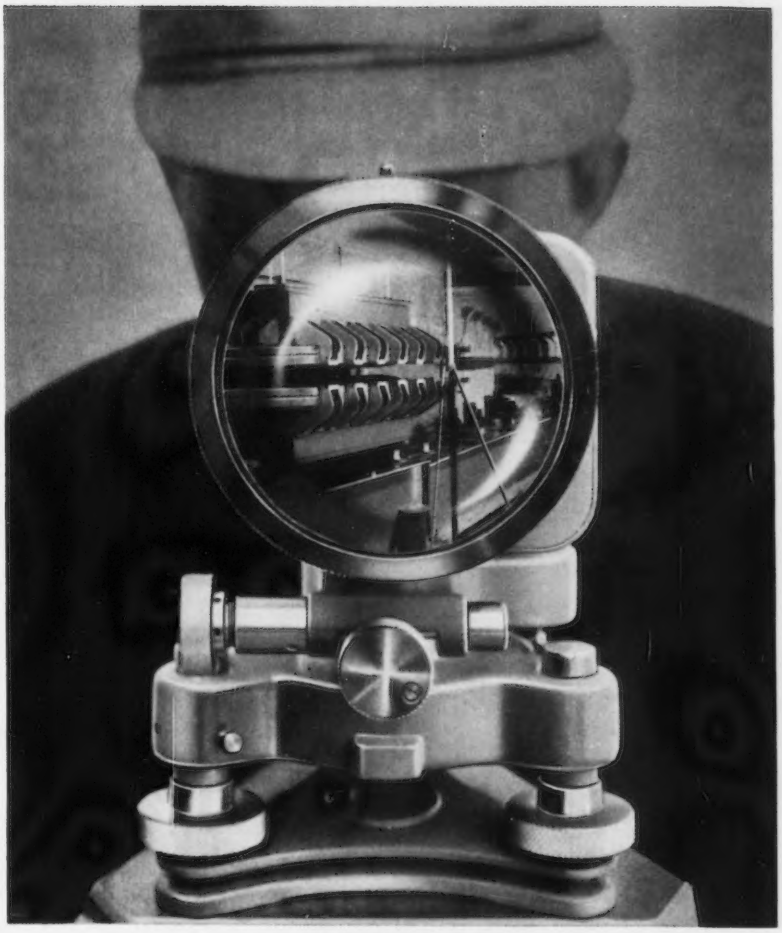
Pickands Mather & Co. shipped a total of 11,381,679 tons in 1960, its best year since 1955. As expected, and for the third year, Erie Mining Co. was the company's highest producer with 5,733,767 tons: 43,006 tons more than one half of PM's entire shipments and 287,503 tons more than came from Reserve Mining Co.'s Silver Bay plant. It was also Erie's record year. The company shipped from all the Lake Superior area ranges except the Vermillion range of Minnesota on which it has not operated since it gave up the Zenith mine in 1958. It shipped from nine Mesabi Range operations, two Cayuna Range, five Gogebic range (Mich.) one Marquette range (Mich.) and one Menominee range (Mich.) a total of 18 properties.

MINNESOTA

Inland Steel Co.'s total shipments for the 1960 season were 2,022,851 tons. The ore came from two properties on the Cuyuna range of Minnesota, Armour No. 1 and Armour No. 2, both underground mines. The Armour No. 1 is mined out: the 1960 ore came from stockpile. The Morris (now closed) and Greenwood mines on the Marquette range of Michigan were 1960 shippers; the Sherwood and Bristol on the Menominee range of Michigan—all underground mines—and the Caland Ore Co., Steep Rock, Ontario, Canada. The Minnesota shipments were 247,822 tons; Michigan, 1,010,135 tons and Caland Ore Co., 764,894 tons. The Caland shipments came from the Lime Point pit, but 1961 production will also include the Mink Point pit and will probably be much larger.

One of the operators in Fillmore county, which borders on Iowa, is the Schroeder Mining Co. In 1960 the company produced 77,500 tons from its pit near Chatfield, on the northern border of the county.

Pres. C. F. Beukema, Duluth, of Oliver Iron Mining Div., told a group of iron range members of the Minnesota house and senate that construction of a major taconite processing plant on the Mesabi range depends on what the current legislature does about the tax picture. He charged that the iron mining companies were being discriminated against as compared to non-mineral properties and that iron range counties, school districts and municipalities were setting up increasing budgets. "If present levels of



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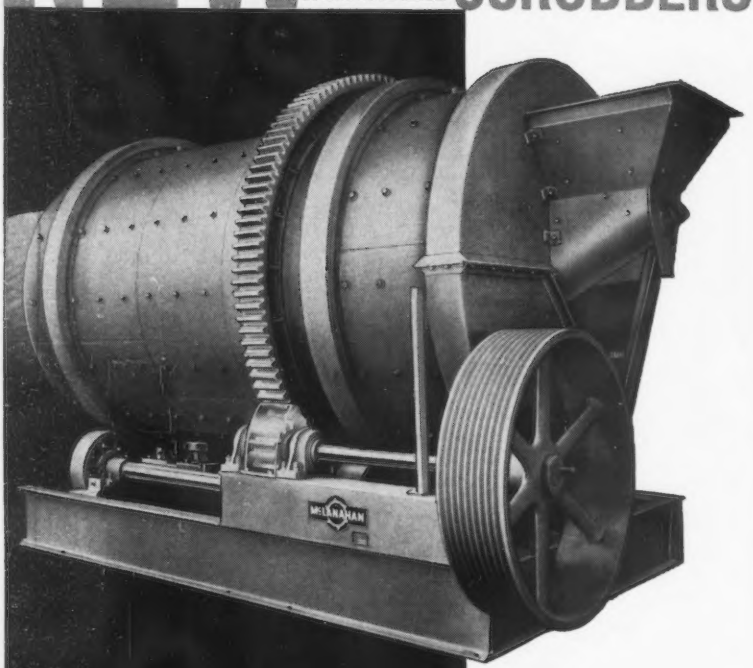

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Minnesota *(Continued)*

these expenditures continue or increase in the next decade while iron ore reserves are being exhausted or depleted, it seems inevitable that serious financial crises will confront each iron range community, one by one.—It would seem unwise, if not foolish for U.S. Steel or any other major producer to commit millions of dollars of plant investment within these districts until there has been a substantial step toward fair assessment practices."

Mr. Beukema pointed out that Reserve Mining Co.'s large taconite development has been out on the sparsely settled east end of the Mesabi Range "where municipalities keyed to high levels of expenditures did not exist, as in the heart of the range where Oliver hopes to locate." He asked that "the legislature submit a constitutional amendment which would insure that taconite and semi-taconite levies are firmly fixed at rates comparable with those assessed against other industrial corporations; and laws establishing an enforceable program for bringing iron range assessment values on non-mineral properties up to the average for that class in the rest of the state in the next not more than four years.

"Preliminary plans for a taconite facility are approaching a point where further planning and progress must be deferred indefinitely unless this session of the legislature takes action which will provide greater assurance that the taconite industry will continue to receive equitable tax treatment which would give security to investments committed in Minnesota." Should this session fail to act favorably on those assurances, Oliver will be compelled to accelerate studies outside of Minnesota for location of its proposed taconite development.

Shipments made by the Lake Superior area companies for the 1960 season:

U. S. Steel Corp.	23,500,164
M. A. Hanna Co.	11,881,252
Pickands Mather Co.	11,381,679
Cleveland Cliffs	6,227,488
Reserve Mining Co.	5,446,342
Jones & Laughlin	2,049,830
Inland Steel	2,022,851
Oglebay Norton	1,576,026
North Range	1,247,006
Pittsburgh Pacific	702,970
Snyder Mining Co.	683,706
Pacific Isle Mining Co.	613,958
W. S. Moore Co.	476,246
Rhude & Fryberger	404,941
Pioneer Mining Co.	172,007
Jessie H. Mining Co.	125,414
Haley, Young Co.	121,059
Republic Steel Corp.	103,861

The only Canadian ore included in the totals is Inland Steel's Caland Ore. The figures do not include a company's interest in other operations; such as Republic's in Reserve Mining Co.; J&L and Inland's in Michigan properties operated by Cleveland-Cliffs Iron Co. W. S. Moore Co. interest in the Zenith mine operated by North Range Mining Co. is credited to the W. S. Moore Co.

Reserve Mining Co. produced 5,446,342 tons of taconite pellets at its Silver Bay plant in 1960, bettering by 25,137 tons its former record of 1957. Total out-

Minnesota *(Continued)*

put of the plant has now amounted to 24,503,038 tons. It is only a matter of time when the taconite concentration plants will have taken the record for total single property shipments. Reserve's expansion program is scheduled to be completed in mid-1963, when it will have a capacity of 9-million tons per year.

MONTANA

J. R. Simplot Co. has purchased a fertilizer plant in Anaconda, as part of a multi-million dollar expansion program aimed at producing new items at the Simplot operations west of Pocatello, Idaho. J. R. Simplot, president, declined to say what the exact cost of the expansion would be, but said it will be the "biggest phosphate producer this side of Florida."

The new plant will produce ammonium phosphate, a fertilizer commonly used, but not made in Idaho. The plant in Pocatello now produces phosphoric acid and triple super phosphate. The company doubled its capacity with a $2-million expansion program in the fall of 1959 and this year's expansion will boost it another 60 to 100%, Simplot stated.

Eminent domain power to acquire surface property for mining was written into Montana law on March 7.

Gov. Donald G. Nutter signed the Legislature-approved measure primarily designed to permit expansion of open pit mining in Butte. The Anaconda Co. said enactment of the bill was necessary if its Berkeley pit operations were to continue. The pit is reaching a depth requiring enlargement of its perimeter.

The governor has yet to decide on a companion bill which guarantees rights of property owners whose land is taken by condemnation action. But favorable action was expected. Property owners would be paid "the value of similar residential property in a similar area not affected by open pit mining operations."

This companion bill also requires that a mining company buy all residential property within 500 feet of the area condemned for pit mining.

"One of the most successful years in accident prevention" was recorded in 1960 by the Anaconda Co.'s Great Falls reduction department, which includes the East Helena slag treating plant and the Great Falls mills of the Anaconda Wire and Cable Co., according to Floyd S. Weimer, department manager. The total accident rate for 1960 of .71% per 1000 shifts worked has only been bettered once—in 1958, when the rate was .66.

"I am sorry to report that there was one fatal accident at the Great Falls plant in 1960," Weimer said in his review of the annual accident report. "However, in the category of 'serious and fatal' our 1960 rate per 10,000 shifts work is .33, which is the lowest rate in this category that we have ever had."

"We feel that our accident-prevention program in 1960 was extremely successful," Weimer said. "There were 14 'slight' accidents in 1960, which is a

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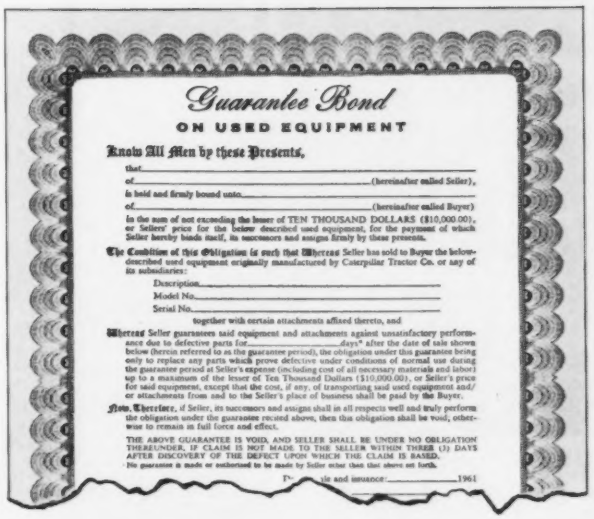

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in the sum of not exceeding the lesser of TEN THOUSAND DOLLARS ($10,000.00), or Sellers' price for the below described used equipment, for the payment of which Seller hereby binds itself, its successors and assigns firmly by these presents.

The Condition of this Obligation is such that Whereas Seller has sold to Buyer the below-described used equipment originally manufactured by Caterpillar Tractor Co. or any of its subsidiaries:

Description_____

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together with certain attachments affixed thereto, and

Whereas Seller guarantees said equipment and attachments against unsatisfactory performance due to defective parts for_____ days* after the date of sale shown below (herein referred to as the guarantee period), the obligation under this guarantee being only to replace any parts which prove defective under conditions of normal use during the guarantee period at Seller's expense (including cost of all necessary materials and labor) up to a maximum of the lesser of Ten Thousand Dollars ($10,000.00), or Seller's price for said equipment, except that the cost, if any, of transporting said used equipment and/or attachments from and to the Seller's place of business shall be paid by the Buyer.

Now, Therefore, if Seller, its successors and assigns shall in all respects well and truly perform the obligation under the guarantee recited above, then this obligation shall be void, otherwise to remain in full force and effect.

THE ABOVE GUARANTEE IS VOID, AND SELLER SHALL BE UNDER NO OBLIGATION THEREUNDER, IF CLAIM IS NOT MADE TO THE SELLER WITHIN THREE (3) DAYS AFTER DISCOVERY OF THE DEFECT UPON WHICH THE CLAIM IS BASED.

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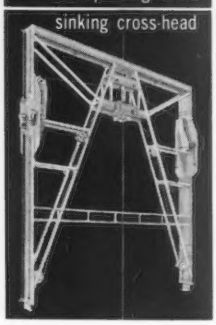
sinking cross-head

Contractors and underground operators throughout the West have come to Card for economical solutions to their needs for unusual and one-of-a-kind haulage equipment.

A few examples are shown here: 5-yard transit-mix car for underground concreting; 22-compartment aggregate batch car with hydraulic gates and built-in conveyor unloader; sinking cross-head with full safety mechanism for best mine safety practices in shaft sinking; movable shaft pouring forms.

transit-mix car

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Montana *(Continued)*

record that has only been bettered four times since 1915." During the year, 19 plant departments operated without a lost-time accident, according to the annual report of L. J. Ingvalson, general superintendent, and the general sheet-rolling mill continues to head the honor roll with a record of 29 years without such an accident.

The record of the electrical department now stands at 14 years without a lost-time accident, and the electrolytic copper refinery completed a full year and more than 45,000 man-days without time lost by injury. Of 26 lost-time injuries in the department last year, 14 were slight and 11 serious.

A group of Spokane area mining men have taken a lease and purchase option on the Bay Chief lead-silver property in Sanders County. The group includes Robert J. Hundhausen, L. L. McLean, G. M. Fansler and Clair Wynecoop. The property includes claims in the Eddy Creek mining district about 22 miles from Burke, Idaho. Sampling work is planned in the area during the 1961 season.

NEVADA

Utah Construction Co. has filed notices on 32 placer claims in the Dayton-Silver Springs area of Lyon County. The firm has conducted an extensive drilling exploration program in the vicinity during the last several months, and it is reported that production work will start later this year. Columbia Iron Mining Co., a subsidiary of U.S. Steel, also acquired extensive iron mining property in Lyon County recently when they filed on 67 placer claims and 99 lode claims in the Pumpkin Hollow area southeast of Yerington.

Eagle-Picher Co. will build a new warehouse at the site of its diatomaceous earth processing plant six miles east of Lovelock, according to Ralph Yocum, superintendent of the operation. The new facility, which will be constructed early this summer, will be used to store swimming pool filter aid during the off-season. Yocum said output at the plant has increased during the last few months and that shipments are now being made in carload bulk lots instead of in paper sacks.

Kennecott Copper Co. is encountering lower grade ores at its White Pine County mines, according to John C. Kinnear Jr., general manager of the operation at Ely and McGill. He said that ore mined in 1961 will run an estimated 76% as compared with 82% in 1956. At present 2.5 tons of waste must be moved for each ton of ore as compared with 2.34 tons in 1956, and copper recovery now is running 12.2 lb per ton as compared with 13.7 lb five years ago. He pointed out that Kennecott's 54-year-old mill at McGill is in need of modernization.

During the five-year period the payroll has been cut from 2200 to 1500, and

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Nevada (*Continued*)

Kinnear said 187 more jobs will be done away with in the near future. Survival of the Whie Pine operations depend on further economies, he told a recent gathering of Nevada legislators and newspaper men.

Nevada Porphyry Mining Co. has opened its properties at Round Mountain for lease to individual miners, and several leasers are now at work. Opened for lease are the hardrock mining areas of the site, which lies 60 miles north of Tonopah in Nye county. The extensive placer areas at Round Mountain were leased and worked by the Round Mountain Gold Mining Co. which was processing 10,000 tpd until 14 months ago. Head of the Nevada Porphyry Co. is Louis Gordon, executive-secretary of the Nevada Mining Assn.

Fire destroyed the hoist house at the Tonopah King mine near the Nye County seat in February. Alarm was turned in by a Tonopah patrolman who could see the flames from down town, and the other buildings were prevented from burning. The blaze started from an oil heater, and the Tonopah King's 500-gallon pumper truck was used to keep it from spreading. A temporary hoisting facility was installed, and mine operations continued uninterrupted. High values in gold-silver ore were recently found in a new crosscut in the mine, and six men are engaged there.

NEW YORK

In June 1960 contracts were let to the Joy Manufacturing Co. by the Adirondack Development Corp. of Keeseville, to conduct an exploratory drilling program at Lewis under the direction of geologist Dr. Severn Brown. Twenty-two holes were drilled and wollastonite was cored in twenty holes under an average overburden of eighteen ft. Based on measured intersections and visually estimated grade, four blocks of drill-indicated ore have been laid out totalling 4,689,000 tons, and averaging 59% wollastonite. As mined in Essex County, wollastonite contains garnet and diopside—hedgenbergite. The diopside can be separated without pretreatment electrostatically. The garnet found with the deposit drilled at Lewis is low grade and would represent 15% of the ore to be mined. Being silica-free, there is a good potential market for this by-product wherever there is a silicosis hazard.

NORTH CAROLINA

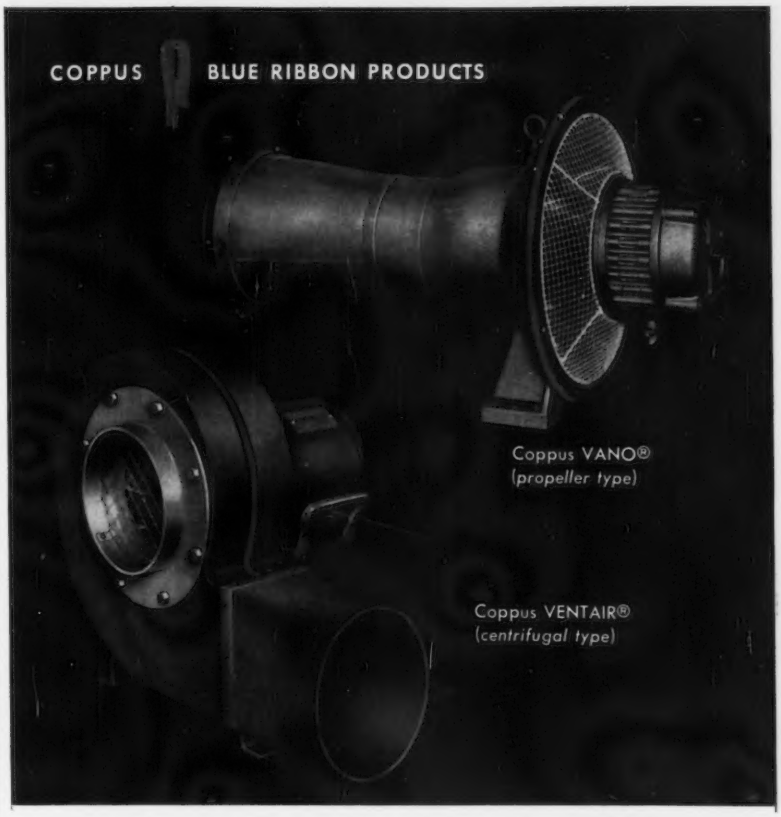
Two members of the Domestic Miners Assn. at Spruce Pine, N.C., headed a group going to Washington Feb. 27th for a week of conferences in an attempt to persuade the new Administration to extend the government's mica purchasing program which is due to end before the year is out. Louis Aldridge, president of the association, and Sam Phillips, former president, were seeking an administrative order extending the Government's mica purchasing program. They said 25.6% of the total work force in the Spruce Pine area, which includes Mitchell, Avery and Yancey Counties, now is unemployed and "unless we are successful, a third of the total working force will be out of jobs." This is in addition to the 25.6% already unemployed at the present time.

Phillips said the Spruce Pine area "produces approximately 85% of the total mica of stragetic grade for the national stockpile." He said "the future of the mountain area looks even worse, since the mining of mica will be coming to an end in a few months unless the Federal Government renews its mica purchase program." "If this should happen," he said, "the community would be hard pressed for survival with more than 50% of the working force out of work." He said the nation's defenses "couldn't get one $10-million bomber off the ground without mica."

OHIO

Titanium Metals Corp. of America announced a 2-million dollar expansion of its Toronto, O., plant.

The expansion comprises construction of new facilities for production of titanium tubing to meet increasing demand of non-military users.



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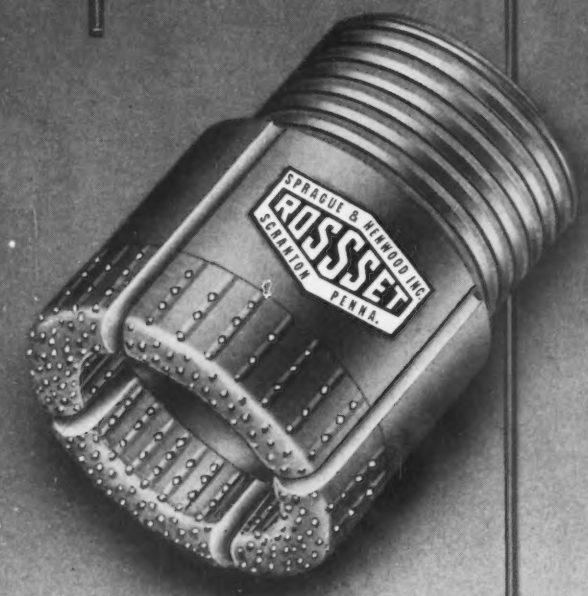

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TENNESSEE

One of the two electro-manganese smelters of Foote Mineral Co., Knoxville, Tennessee, was recently closed. Approximately 100 men were employed at the smelter where manganese ore was smelted to yield a high purity manganese metal. Foote's other smelter was not affected by the shutdown.

A public hearing was held in Nashville during February by the Tennessee State Representative Conservation Committee on a bill to require strip miners to refill their mines once they are depleted. The bill would require strip mineowners to either reforest or replant the refilled mine.

American Zinc, Lead and Smelting Co. reported record earnings and a 10% increase in sales for the year 1960. Sales during the year amounted to $55,432,647. Total capital expenditure commitments for mineral lands, plants, and equipment for new mines amounted to $2,662,608. American Zinc's largest mining operation is in the East Tennessee zinc district.

The Aluminum Co. of America at Alcoa plans to shut down an old continuous rolling mill connected with the smelter. The mill is obsolete and will be replaced with new equipment under a new modernization program, costing approximately $8-million. Approximately 10 people are affected by the shutdown.

TEXAS

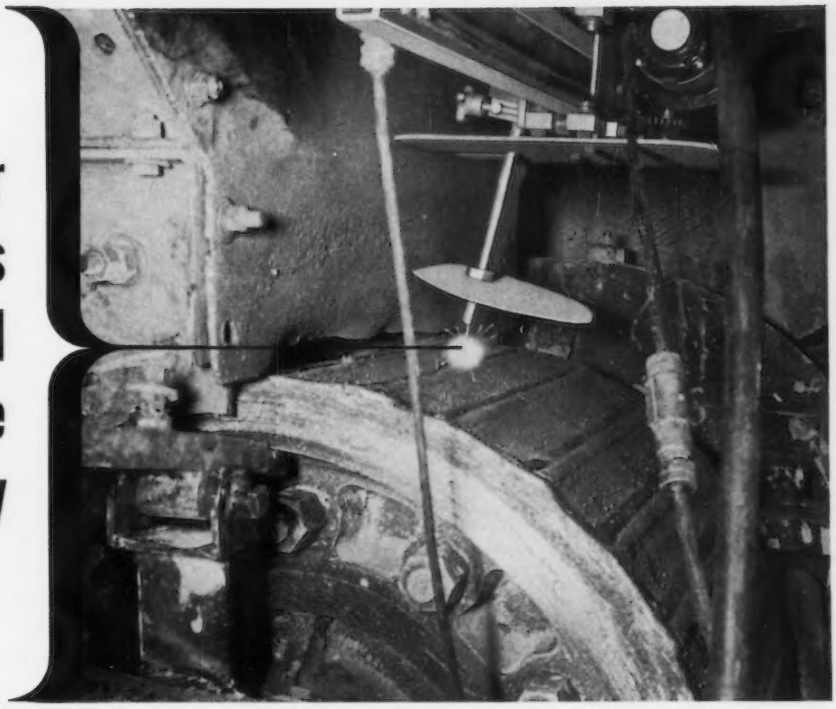
The Bureau of Economic Geology of the University of Texas states in its annual report for 1960 that "the most significant developments in the mineral industry of Texas (excluding the oil and gas industry) were connected with uranium, iron, barite, potash, sulfur, talc, water, and cement."

During 1960 plant and mill development was extensive, according to the BEG report which outlines the various projects now under way as follows:

"Susquehanna-Western, Inc., began construction of a 200-tpd mill to process uranium ores in the area of Falls City. This mill provides the first market for the uranium ores developed in Karnes and Atascosa Counties during 1955 and 1956 and should encourage additional prospecting in the area. The $2-million installation will utilize acid leach and solvent extraction and provide Texas with a new mineral industry."

"Barite made news in widely separated areas of the State. Near Van Horn in Culberson County, Continental Minerals of Fort Worth carried on exploration and development work on their Seven Heart Gap properties and began construction of a mill on the Texas & Pacific Railroad about six miles east of Van Horn. The mill began operation in January. About 600 miles to the east, in the Houston area, International Minerals and Chemical Corp. constructed a highly automated plant to process both domestic and foreign barite ores."

crusher rolls restored to size automatically



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Now you can rebuild your crusher rolls to size and hard-face them automatically *in position!* The STOODY CRUSHERMATIC, a Stoody portable automatic welding system, temporarily suspends over the crusher rolls; can be used with your regular semi-automatic wire feeding unit and a power supply of adequate capacity.

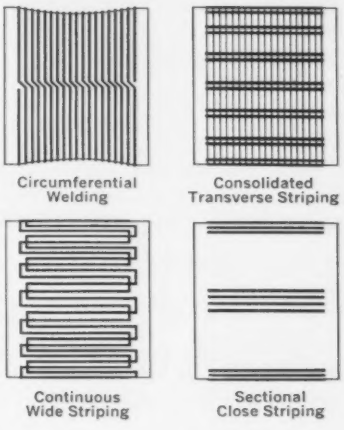
Cuts Maintenance Overhead 50%

Because welding is continuous, maintenance costs are drastically reduced. Crushermatic actually deposits up to 20 lbs per hour on continuous duty... 300% faster than manual welding and 200% faster than hand-held semi-automatic welding!

Easy on the Weldor

Crushermatic takes the work out of welding—takes the weldor out of the crusher! All necessary controls are *outside;* the weldor works in clean smoke-free air, in comfort.

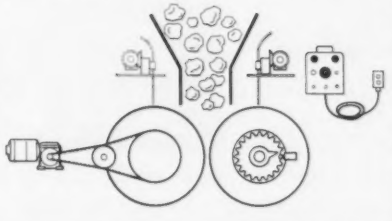
VERSATILE WELDING PATTERNS



Electronic controls in the Crushermatic unit permit a wide variety of welding patterns, producing virtually any desired bead spacing. The illustrations show typical possibilities.

SIMPLE INSTALLATION

Permanent brackets are welded in the crusher supporting the CRUSHERMATIC unit in proper position over the rolls. In some cases it is necessary to cut an entry door through the crusher chassis and to fabricate a removable access cover in the screening hopper to expose the roll.



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Texas (*Continued*)

"Developments in the sulphur mining industry during 1960 included installation of a new mining and manufacturing operation by U.S. Sulphur Corp. at High Island dome east of Galveston."

"Late in 1959 the Pioneer Talco Co. completed their mill at Allamoore, Tex. This is the first processing unit to be constructed in the growing Hudspeth County talc district. Production from active properties in this district totaled about 60,000 tons in 1960."

The report also states that a new direct reduction process to make steel from low-grade ore—the Strategic-Udy process—will be used by two companies. Both Sovereign Steel (Palestine) and Lone Star Steel (Daingerfield) will enter into direct reduction of iron ores.

Texas also witnessed a resurgence of potash exploration and at the end of the year drilling was in progress in Loving County. Discoveries of commercial deposits of potash in Texas could lead to the establishment of a major mining industry in the State.

UTAH

American Smelting & Refining Co. is reducing its regional exploration division at Salt Lake City to status of an office operating under Tucson, Ariz. district, the firm reports.

Exploration continues under the department headed in New York by C. P. Pollock.

Mining and western smelting operations at Salt Lake City are not affected by the changes in the exploration effort.

The small, but profitable, uranium ore reserve of Col-U-Mex Uranium Corp., at Utah's Big Indian district will be mined out within a year, according to plans of the firm.

Shareholders were told at Col-U-Mex annual meeting in Salt Lake City that profits from this development would be re-invested in resource situations.

Operating control of Col-U-Mex, an Albuquerque, N.M. firm, was acquired last year by Federal Resources Corp., Salt Lake City.

Standard Metals Corp., Moab, is operating a joint venture on the Col-U-Mex uranium properties in Utah. These properties are the principal asset of the firm.

Kern County Land Co. has made an offer to acquire Bonneville Ltd., Wendover, Utah, solar evaporation potash producer, as the first step in their recently launched minerals acquisition program. Kern has also conducted core hole drilling and other reserve determination on trona properties in the Green River, Wyo. natural soda ash district, and is completing prospecting in the Raymond Canyon area on a major phosphate rock reserve.

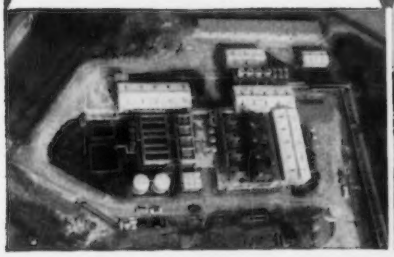
W. T. Griswold, president of Kern, expects to have partners in the various mineral developments and is currently discussing partnership arrangements.

A patent relating to production of rhenium and rhenium compounds of

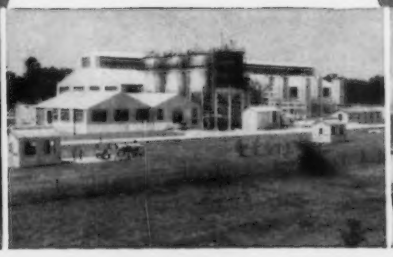
SULPHUR

POINTS OF DEPARTURE

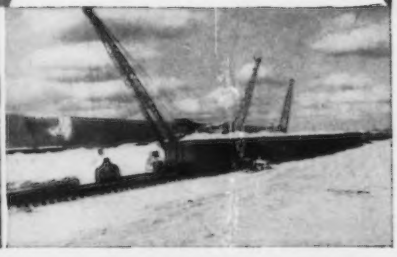
FANNETT, TEXAS



MOSS BLUFF, TEXAS

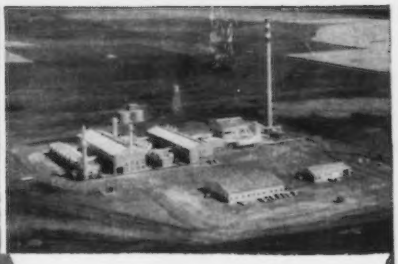


NEWGULF, TEXAS



SPINDLETOP, TEXAS

WORLAND, WYOMING



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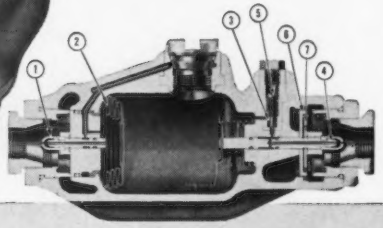
(6) Positive pressure differential valve assures correct oil feed for all air flows — eliminates oil waste.

(7) Shut-off valve automatically stops air when oiler is empty. As oil supply goes down, bellows (2) expand and contact the shut-off plunger, depressing it until the valve reaches the automatic shut-off position.



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AT-906

Utah (*Continued*)

ultra-high purity has been issued by the U. S. Patent Office and assigned to Kennecott Copper Corporation.

The invention is U. S. Patent No. 2,972,531, known as a "Process for Production of Ultra High Purity Rhenium," and is especially concerned with effectively removing substantially all contaminating metal ions from a rhenium source material already highly purified with respect to metallic contaminants.

Work on the process was performed by S. R. Zimmerley, director of Research at the Kennecott Research Center; E. E. Malouf, project development engineer, and J. D. Prater, chief of the hydrometallurgy section of the Kennecott Research Center.

The process involves the preferential precipitation of various contaminating metal ions from a rhenium-bearings solution by the introduction into the solution of a soluble xanthate salt as a precipitant for the metallic ions.

U.S. Steel Corp. has recently opened a new Raw Materials Research Laboratory at its Geneva Works, Provo, Utah. The 30-man research center will conduct intensive studies on western iron ores, coal, coke, limestone and other steelmaking raw materials. The goal of the center is to find better, more effective ways of using western raw materials to produce high quality steels more economically.

Among research projects slated for the new center will be the testing of drill cores sent in by western investigation teams, studies on the upgrading of iron ores and limestones, research on improved ways of agglomerating iron ore, and studies on coal blending and carbonization.

WASHINGTON

Chief Jo Tungsten, Inc., Okanogan, has boosted the output of its tungsten mill to 100 tpd. The company's tungsten deposits are located near the Columbia river about 25 miles downstream from Grand Coulee dam in eastern Washington. Development work was started at the property in 1956 and a pilot mill went into operation in 1957.

Western Gold Mining, Inc., Seattle, announced plans to expand development work at the old Eureka and Bonita mining property in the Harts pass area near Winthrop. The company plans an addition to its mill on the basis of gold ore showings at the property.

WISCONSIN

The discovery of deposits of beryllium near Tigerton in Wisconsin's Shawano County was reported Feb. 27 by George Friedrich and Robert Bruning, amateur geologists who have been working the area.

The men said they found eight possible deposits of the crystalline ore.

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Now the new 45-ton six-wheel Mack M Model, made for mining with mining-duty components, is giving new meaning to durability and trouble-free performance.

Among the contributors to its all-around excellence are a Mack off-highway bogie that's the last word in rugged, load-carrying tandem axle capacity . . . a sturdy frame that stands up under jarring drop loads of big shovels . . . and a new cab that lets drivers concentrate on quick, safe cycles without concern about the vehicle.

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WYOMING

Big Horn Gypsum Co. started dynamiting in February at its gypsum ore deposits two miles south of Coday and began its new processing plant in March. Gypsum ore will be trucked to the plant site two miles north of Cody and stockpiled until operation of the $3-million plant begins. The plant will employ about 125 men and will produce about 100-million ft of gypsum board each year.

U. S. Steel's big project near Atlantic City to build a completely integrated taconite iron ore mining and beneficantion facility is expected to be completed before the end of 1962. The Atlantic City operations, to be turned over to Columbia-Geneva Steel, will use conventional open pit methods to mine the taconite iron ore which contains about 30% iron. Present plans call for the ore to be mined on 25 ft benches, with a 37½ ft safety berm left every third level.

Before the first truck load of taconite iron ore can move out from the mine, some of the major units that must be built include: Crushing and screening facilities, ore concentrating plant, ore agglomeration plant, loading and shipping facilities, and extensive water storage and handling facilities. Also to be built are general and mine office buildings, maintenance shops, warehouses and testing laboratory, as well as a dispensary, fire and ambulance stations, and a 76-mile spur railroad from the operations to a Union Pacific RR line. (See E&MJ, July 1960.)

Acting Governor Jack Gage has signed into law a bill passed by the 1961 Wyoming Legislature establishing a new road program designed to help construction of emergency roads to newly-developed oil and gas fields, uranium mines and other industrial areas. The bill sets up a $1-million fund in the Wyoming Highway Dept. which counties can match, up to $200,000 a biennium, to build roads to new industrial areas.

The bill's sponsors pointed out that frequently when new oil and gas fields or uranium mines are discovered counties have no money in their road program to construct highways to the industrial developments. The bill was intended primarily to help in construction of a road from Riverton to the Gas Mills uranium mines and from Big Piney to the Calpot oil field, but several other areas in the state will qualify for the program.

IN CANADA

ONTARIO

Tonnage milled and production at Upper Canada Mines' gold operations in the Kirkland Lake area established new records in 1960. Output was valued at $1,858,472, from 207,915 tons milled for average recovery of $8.93 per ton—compared with production of $1,778,695 from 200,773 tons for average recovery of $8.86 per ton in 1959. Daily mill rate reached a new high average of 568 tpd. Completion of the major construction program in the mine and mill this year will permit the company to proceed with depth development.

Aunor Gold Mines added some 295,000 tons of new ore between the 2125-ft and 2900-ft levels during the past year at its Porcupine area gold producing mine. In addition, detailed examination on the 3500-ft level has indicated six oreshoots having an average width of 9.7 ft, aggregate length of 1550 ft and average grade of 0.363 oz gold per ton. Ore reserves at year-end were estimated at 1.12-million tons grading 0.358 oz gold per ton, an increase of 30,000 tons in the year. Tonnage milled in 1960 amounted to 265,000.

Leitch Gold Mines has run into high grade gold on the 4425-ft level at its Beardmore area gold operation. Officials report that the ore is comparable to that on the 28th level, some 300 ft high up, where a continuous ore length of 420 ft ran 3.5 oz gold cut grade across 21 in. This latter, to date, is the richest oreshoot yet found in the mine. The new development is in the same vein structure, the No. 2.

Rio Algom Mines has clipped another $12-million from its bond indebtedness, leaving a balance of only $12,637,500 to

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Ontario (*Continued*)

retire. The company, which operates three uranium producers in the Elliot Lake area, has made quick work of its debts. In the 12 months to June 30, 1960, its debts were reduced by about $34-million to about $78-million. By the end of September, 1960, that figure had been reduced to $57 million and at the beginning of 1961 debts stood at $24-million. The most recent reduction removes the last of the restrictions imposed by the trust deed on payment of dividends.

Caland Ore Co. expects to boost shipments of iron ore by more than 30% in 1961 from its Fall Bay area mines at Steep Rock. Initial production in the past year totalled 764,893 tons and target for the current year is set at 1-million tons. The company ships its entire production to the parent company's (Inland Steel Co. of Chicago) Indiana harbour steel plant.

Strathagami Mining Co. has tied up a 10-mile strike length of iron formation in two parallel ranges in the Temagami area. Extensive diamond drilling by Cliffs of Canada, which is managing the project, has indicated substantial tonnages of open pit magnetite iron ore grading 30-35% Fe.

Some five potential pit areas have been located and widths average 200 ft.

Increased operating efficiency and higher royalty payments are expected to result in improved results for Steep Rock Iron Mines in 1961. A new 750-tph screening plant is being prepared for service at the Hogarth mine—will be the company's third ore tailoring plant at the Steep Rock iron operations. During 1960, 340,-496 tons of sized ore were shipped.

Higher royalty payments will result from increased shipments from the Caland Ore Co. lease.

Preliminary pilot plant tests by Anaconda Iron Ore (Ontario) at its magnetite iron property near Nakina have given encouraging results. A concentrate of 70-71% iron and under 2% silica has been produced from batch tests of material averaging 28-30% iron, taken from open pit.

The International Nickel Co. of Canada, Ltd., plans to triple iron recovery capacity at the Copper Cliff plant. Plant expansion is scheduled for completion in 1963.

Inco will continue to use the process, developed by the company, already successfully operating in the existing iron ore recovery unit. This process involves solid state pyrometallurgical operations, and the removal of nickel by atmospheric pressure leaching in high-capacity units. About 1.2-million short tons of nickeliferous pyrrhotite per year will be treated at the plant. It is expected that the plant capacity for producing iron ore pellets containing 68% iron will be increased to 900,000 short tons annually and that more nickel will be recovered from the same quantity of pyrrhotite than is possible in the nickel smelter.

Reportedly, the diversion of this large quantity of pyrrhotite to the expanded iron ore recovery plant will effect a 40% decrease in the quantity of material that would otherwise be handled by the nickel section of the Copper Cliff smelter. The change in procedure is expected to result in smelting economies and provide a basis for further major advances in nickel extractive metallurgy.

NEWFOUNDLAND

Maritimes Mining Corp. turned out 24,-008,500 lb of copper in 1960 from its operations at Tilt Cove. Average milling rate was 2106 tpd, up from 1963 tons daily in the previous year. In 1959 the mine produced 24,378,300 lb of copper. Mill rate was boosted in the final quarter of 1960 and averaged 2223 tpd in the three-month period. The slightly lower production in 1960 reflects the somewhat lower grade of ore treated during shaft sinking and deep level development.

SASKATCHEWAN

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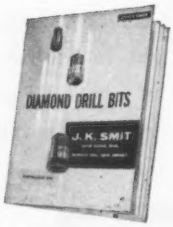

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Grosse Ile, Michigan

Saskatchewan (*Continued*)

area of northwestern Saskatchewan have been investigated and evaluated by Dr. J. B. Mawdsley, head of the geology department of the University of Saskatchewan.

Dr. R. L. Cheesman, chief geologist for the Saskatchewan department of mineral resources, said the percentage of iron in the ore ranges from 5 to 30% with a 15% average.

A flurry of gold mining activity which developed in northern Saskatchewan is expected to intensify this year, according to the provincial mineral resources minister, J. H. Brockelbank.

He said that exploration work is being concentrated in five areas—Sulfide Lake, Waddy Lake, Foster Lake, Brownell Lake, and Amisk (Beaver) Lake. A total of nine mining or mineral exploration companies are working in the areas, which are immediately west and northwest of the mining city of Flin Flon on the Saskatchewan-Manitoba boundary.

The companies include Sico Mining, Canadian Nickel Co., Studer Gold Mines, Waddy Lake Mines, Kerr-Addison, Augustus Explorations, Prospectors Airways, and Hudson's Bay Mining & Smelting Co.

An exploratory draft of proposed changes in Saskatchewan mining regulations has been made available to key mining companies for comment, prior to final revisions which were to come before the provincial legislature in late March.

J. T. Cawley, deputy minister of mineral resources, said industry spokesmen would have several opportunities to suggest changes and present arguments before enactment of the proposals into law. The draft regulation changes as they stand have evoked strong opposition from some mining interests. It is claimed the proposed legislation will weaken title to mineral properties, limit surface rights, and exclude large areas from prospecting because of introduction of a concession-type system. Also opposed is a proposed 12½% royalty, more detailed requirements for evidence of work, and a requirement that all ores must be treated and refined in the province of Saskatchewan.

Another proposal, covering the application of airborne geophysical survey work to claims staked as a result of such survey, was widely approved. So was a proposal that claim posts and blazing in the staking of large blocks of ground be partially eliminated.

BRITISH COLUMBIA

The government has introduced a bill that will permit it to subsidize copper mined, smelted and refined in B.C. to a total of $2.5-million over 10 years.

To be known as Bill 35, it provides that the minister of mines, with cabinet approval, may pay a bounty of 1¢ a lb on blister or refined copper.

The bounty is not to cost the government more than $250,000 a year for a maximum of 10 years.

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Two of these LeTourneau-Westinghouse TORQMATIC-equipped LW-80 coal haulers replaced five 26-ton trucks at a Kentucky coal mine. "Even in wet weather and with 90-ton loads," the company reports, "the TORQMATIC units get underway slow and easy. A transmission like this that can take up the shock and, at the same time, give us the full benefit of 525 horsepower is bound to cut our maintenance costs to a minimum."

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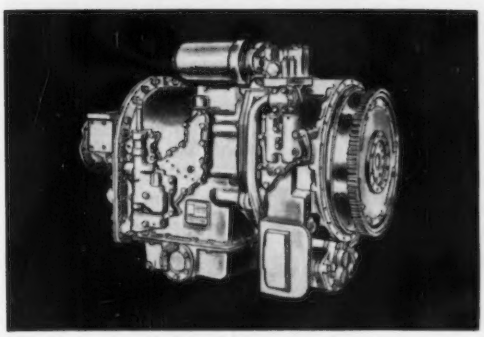
This Kenworth Model 849 logging truck is big as all outdoors, yet drives about as easy as a small pickup. Reason? Its Series 5000 TORQMATIC Converter-Transmission team takes the guesswork out of shift-work, eliminates the clutch pedal, is so simple to operate that the newest drivers look like "pros" after a day at the wheel.



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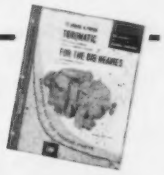

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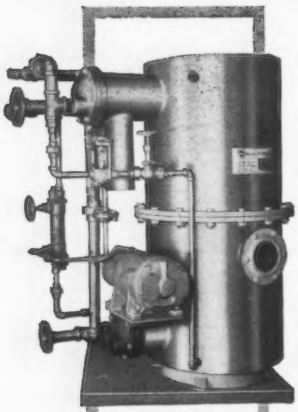

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B. C. (*Continued*)

A $500,000 exploration program with emphasis on gold and silver is planned by Rayrock Mines Ltd. The company is continuing drilling on the gold property of Bridge River United Mines and if results are favorable will take control of the company after expenditures of $115,000.

Aluminum Co. of Canada will shut down its Kitimat smelter about mid-June for "five to eight weeks" to permit $1-million repairs to the Kemano tunnel.

Tests on the tunnel over the past few months indicated "an abnormal increase of hydraulic losses." The company says it believes that in addition to trapped air, there is fallen rock obstructing the passage.

For three years, Alcan has been concerned about pressure losses and attributed them to entrapped air, and corrected it by passing greater volume of water through. Now, the tunnel will be completely drained to permit removal of the obstruction.

The smelter has been operating at its rated capacity of 192,000 tons of aluminum per year, so deliveries to customers should not be affected by the shutdown since inventories are adequate to continue supply.

Universal Minerals Ltd. has completed a $20,000 exploration program consisting of 12 trenches and five diamond drill holes at its 14-claim silver-lead-zinc property in the Salmo district. A mineralized area has been exposed over a strike length of 980 ft and from 12 to 20 ft wide on the surface. Drilling indicates that mineralization is improving at depth.

Granduc Mines Ltd., announced it will launch a $500,000 development program at its northern B.C. property this spring. Objectives are to explore by underground work and diamond drilling the Granduc ore zone to the north and south of the area already developed to a length of 4600 ft; to continue prospecting areas staked last year in an effort to find new orebodies; to transport drills, camps and crews to the surface drilling sites by helicopter.

QUEBEC

Quebec Lithium has lost no time in getting into steady production at its lithium operation in the Val d'Or area. The refinery is now turning out nearly 10,000 lb of lithium carbonate per day on its way to an ultimate 15,000 lb daily. Plant feed amounts to approximately 35 tons of raw lithia concentrate daily, and this is expected to rise to 50-60 tons when the plant reaches the planned rate.

New Hosco Mines is continuing to study means of bringing its Mattagami area copper-zinc property into production. Diamond drilling has indicated 2,187,000 tons averaging 2.70% copper plus a possible 269,000 tons averaging 2.19% copper and 958,000 tons of 7.96% cop-

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Stearns 30"x 72" INDOX V wet drum separator at work in a heavy media system. Customers report media loss reductions of 50% or more over other separator types in applications like this.

Important design and cost advantages proved in the field by over 100 installations since late 1958 have added up to real profit-performance for users.

Stearns INDOX V permanent magnet wet drum separators (Type WPD) have established new cost reduction and performance standards for the mining industry in both heavy media and ore concentration applications.

Performance Proved in the Field

For example, here's what one user recently reported: *"Comparing the performance of a Stearns WPD against a larger electro unit in our two parallel iron ore heavy media systems proved the superiority of the* INDOX *separator to us."* Here are the exact results of that test with the figures indicating loss of magnetic media in grams per gallon of feed under varying feed rates but with conditions in the two circuits always identical:

Test	30" Dia. INDOX V	36" Dia. ELECTRO
#1	0.24 gpg	0.32 gpg
#2	0.36 gpg	0.96 gpg
#3	0.60 gpg	0.68 gpg

However, performance is just part of the story. Stearns INDOX V separators offer other significant advantages, such as:

Lower Initial Cost — Amazing INDOX V permits cost reductions never before possible.

Lighter Weight — Electros are twice as heavy, and ALNICO permanent types are up to 60% heavier than Stearns INDOX V WPD separators, which further adds to initial cost of competitive units.

Less Costly to Operate — Electros require current for coil energization, which in the average installation can run up to $500 annually.

Lower Maintenance Cost — No coils, rectifiers or controls to burn out with INDOX V units. You get permanent and uniform magnetic strength even down to −40° C; all non-magnetic stainless steel tank that resists corrosion damage and further adds to magnetic efficiency; anti-friction bearings that are completely protected against dirt and water damage; and many other features which not only add to service life but simplify maintenance when it's needed.

INDOX V Opens New Design Era

But what is INDOX V? It is a highly oriented barium ferrite ceramic magnet material developed by Indiana Steel Products Division of Indiana General. INDOX V possesses unique advantages for separator design — light weight, high electrical resistivity, great resistance to demagnetization (stable to −40°C), and high magnetomotive force per unit of length. Made of low-cost, non-critical raw materials, INDOX V supplies an energy product, on an equivalent weight basis, equal to ALNICO V and three times greater than that of ordinary un-oriented ceramic magnet material. Because of the increased design flexibility and other advantages offered by INDOX V, Stearns engineers have been able to achieve dramatic improvements in separator efficiency with the added bonus of low cost.

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Stearns offers INDOX V wet drum separators in diameters of 30" and 36", with magnet widths from 15" to 72", single, double, or triple-drum construction in either concurrent or counter-rotation styles.

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Quebec (*Continued*)

per. In addition, about 1-million tons of zinc ore grading 7.96% has been indicated in another sector. Metallurgical test work has given satisfactory results and present thinking is along 900-tpd operation. A highway into the area and to the property is expected to be completed shortly and a railway will be in operation into the area before the end of 1962.

Malartic Gold Fields is conducting mill tests at its gold producing and custom mill operations in the Malartic area in an effort to boost tonnage by some 150 tpd. The mill has recently handled as high as 2345 tons in a day, but growing requirements of several ore shippers and the finding of more ore in the company's mine have combined to put additional pressure on mill capacity. The mine, which was supposed to have closed in 1959 and then at a somewhat later date, is proving hard to kill. In 1960 new ore was almost sufficient to cover tonnage milled. Reserves at the end of 1960 were calculated at 313,000 tons averaging 0.175 oz gold per ton. This compares with 375,000 tons a year earlier.

The copper ore zone on the Joutel Township property of Prospectors Airways and Kerr-Addison Gold Mines has been extended for a drilled length of 700 ft. Three drills are currently in operation in an intensive program to test the showing along strike and up and down dip. Values continue to offer encouragement.

Drilling by Radiore Uranium Mines on the optioned Bell Channel ground in the Mattagami area has indicated a promising copper zone. The zone has been indicated for a length of 300 ft with average width of 25 ft. No overall average value has been calculated but several intersections were obtained in the 2-3% range. Three of seven holes completed so far this year have given ore values. Drilling is continuing.

Consolidated Vauze Mines is considering installation of a milling plant at its base metals property in the Noranda area. A mill of 350-tpd capacity is suggested. While no official announcement has been made yet, it is understood that a decision on a mill is close.

Molybdenite Corp. of Canada has advanced plans for expansion of its molybdenite producing operations at La Corne. A start as been made to up mill capacity although no details have yet been disclosed as to tonnage target. In the 1960 fiscal year the mill handled an average of 600 tpd.

Solbec Copper Mines, wholly-owned subsidiary of Hastings Mining and Development, plans to be in production by year end at its copper-zinc-gold-silver property, some 50 miles northeast of Sherbrooke. The shaft is down to below 875 ft on its way to the objective of 1250 ft. A start has also been made on the 1000-tpd capacity mill. Detailed drilling has indicated 1,450,435 tons to vertical

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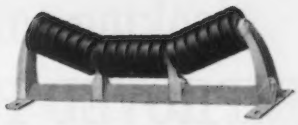

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Automatically trains belt and protects belt edge from wear caused by misalignment.

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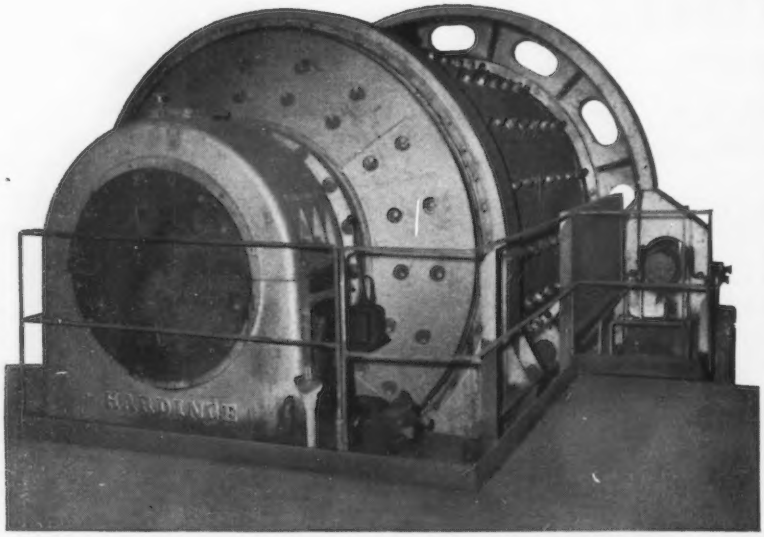

An 8½' diameter by 12' long Hardinge Conical-Head Rod Mill grinding coke. Note the end peripheral discharge hood, starting lubricator and water-cooled bearings.

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Quebec (*Continued*)

depth of 600 ft. Average grade is calculated at 1.94% copper, 4.10% zinc, 0.59% lead, 0.016 oz gold and 1.18 oz silver per ton. Hastings is owned 84% by East Sullivan Mines, Sullivan Consolidated and Quebec Lithium Corp.

St. Lawrence Columbium is nearing completion of its concentrator in the Oka District, and expects to have some production from the 500-tpd mill in August. Ore will come from the company's open pit mine and a 50-tpd 55% columbium pentoxide product will come from the mill. (E&MJ, October 1960.)

Eastern Canada's first zinc refinery will be built in Valleyfield to process concentrates from the new Mattagami Lake mining camp in Northwestern Quebec.

The $30-million refinery will employ 475 workers and would turn out 165,000 tons of zinc annually. The plant is a project of Mattagami Lake Mines Ltd., which is controlled by Noranda Mines, McIntyre Porcupine Mines and Canadian Exploration Ltd.

A bill authorizing construction of a 60-mile branch railway line to the Mattagami Lake area is now before Parliament. The line, which will cost $8.4-million, was approved by the Commons railway committee and will soon be presented to the Commons for final approval.

Work on the mill to produce zinc and copper concentrates from ore mined by Mattagami Lake Mines is scheduled to start this spring.

Merrill Island Mining Corp. Ltd. has announced a diamond drill intersection in what appears to be a new ore zone below its 925-ft. level. A 60-degree down hole, drilled on a northeast bearing, intersected 31.9 ft of ore averaging 5.98% copper at a horizontal distance of 650 ft from the shaft and 850 ft vertically below the 925-ft level.

IN LATIN AMERICA

BRAZIL

Brazil's Companhia Vale do Rio Doce shipped a record 4,269,000 metric tons of iron ore abroad in 1960, according to the mining firm's annual report. Profits were 4.1-billion cruzeiros, or approximately $20.5-million at the free rate of exchange.

Last year's shipments were 33% above 1959 figures. Smaller exporters accounted for an additional 1-million tons in ore shipments in 1960.

The company said its export goal this year is 6-million tons, and installations are reported under way to permit annual shipments of up to 20-million tons. These installations are chiefly loading-dock expansion at Vitoria and construction of a

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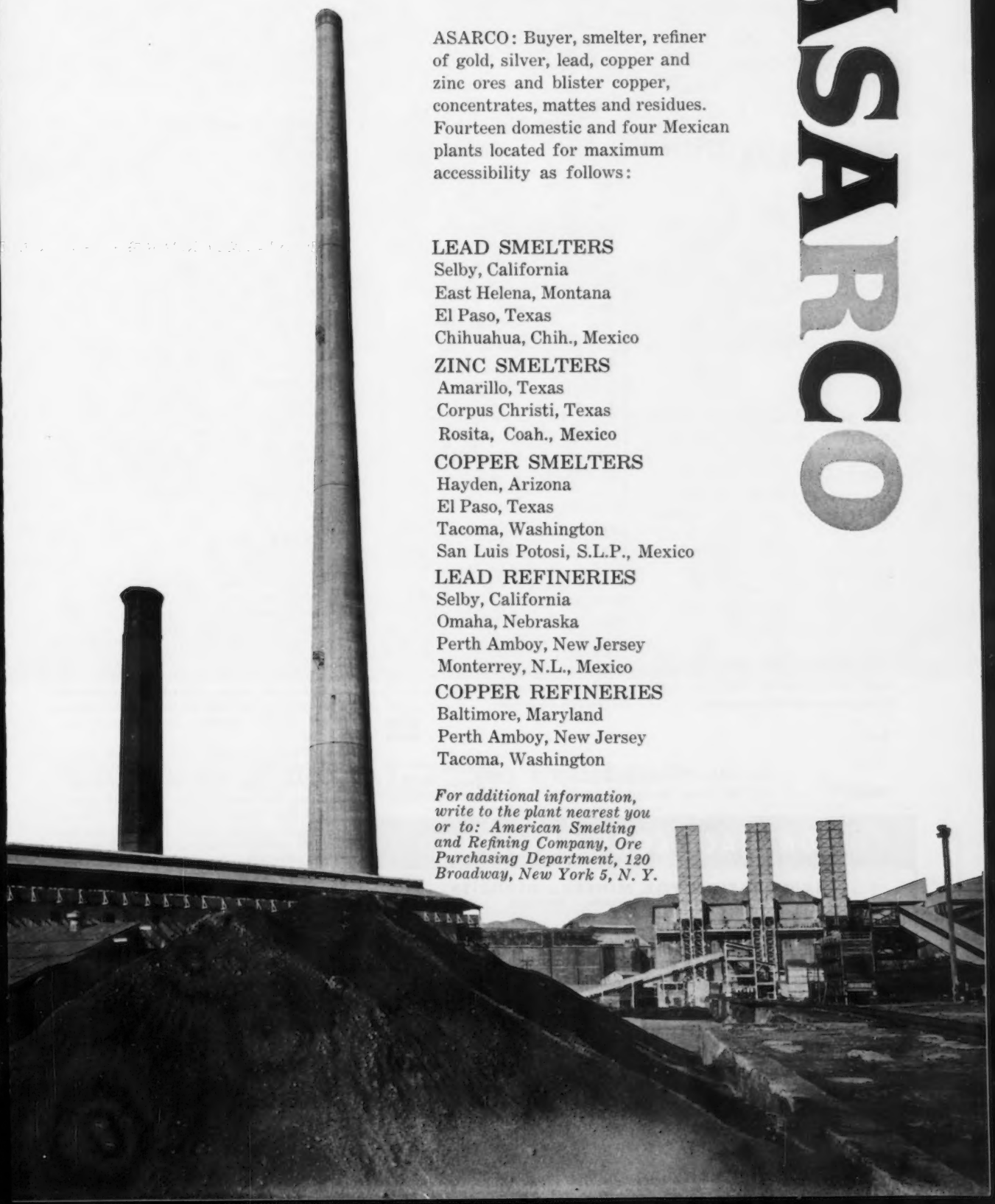

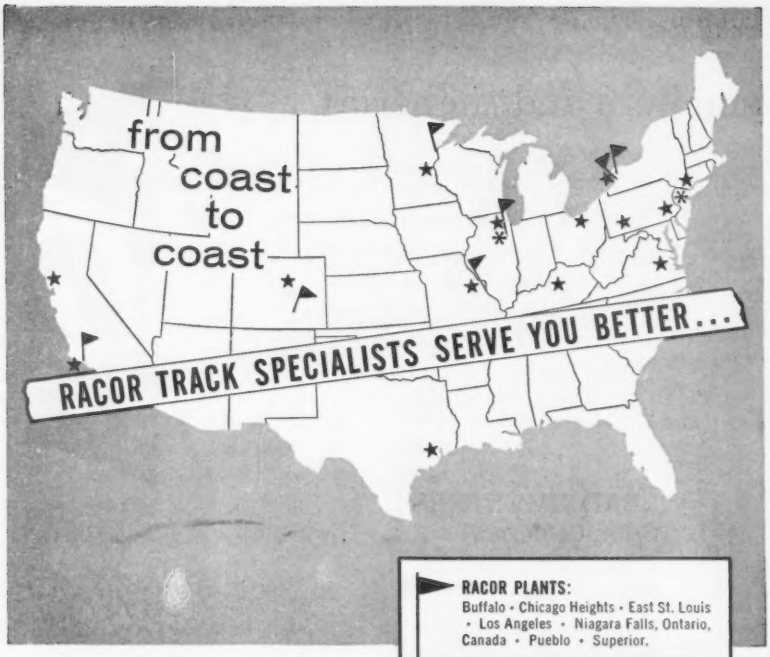

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Brazil (*Continued*)

railway link from Itabira, now the company-operated railroad's terminus in Minas Gerais, to Belo Horizonte. This link would give the Vale Doce company access to rich and extensive hematite deposits in the Paraopeba Valley. The M. A. Hanna Co.'s $50-million plans for developing iron deposits in this region are presently stalled pending a final decision from the new Janio Quadros government.

Brazil's manganese mining industry has developed steadily during the past six years to be one of the three largest producers of manganese in the world—with 1960 exports of the metal to the U.S. totaling $24,248,000, a rise of $4,393,000 over 1959.

Brazil has reserves estimated at more than 100-million metric tons, sufficient for the output of more than 3-billion metric tons of steel, and, in the opinion of metallurgists, practically inexhaustible.

While the single largest manganese reserve, estimated at 32-million metric tons is located in Mato Groso (averaging of 46% of manganese content), the most outstanding exploitation of the metal is in Amapa, Brazil's northern territory which has total reserves of 31-million metric tons. Nearly all of the annual production of Amapa is exported to the U.S., and this output, combined with that of the other manganese producing areas makes up about 42% of the total U. S. imports of the metal.

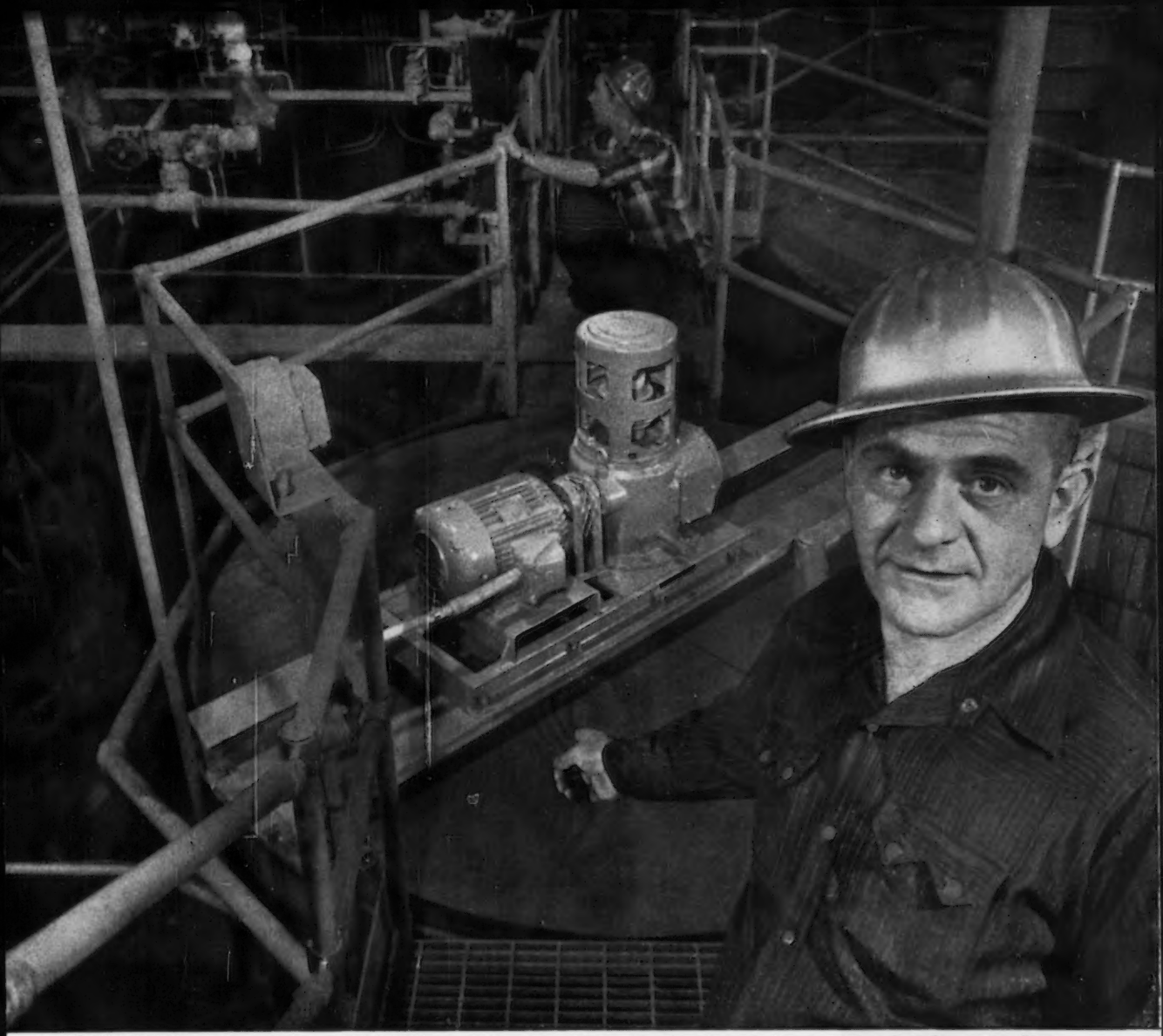
CHILE

Compania Minera Santa Fe is investigating the large "El Laco" deposit in Antofagasta province. The deposit lies 190 miles due East from the port of Antofagasta at an elevation of 14,900 feet and is 40 miles from the depot of Olacapata on the railroad from Antofagasta to Salta. The deposit contains magnetite and hematite and nearby rocks are chiefly andesite, rhyolites and dacites.

There exist four main outcrops: Laco North, which is approximately 1 sq km in area; Laco South which is 0.6x0.13 miles; San Vicente Alto, 0.37x0.19 miles and San Vicente Bajo, 0.19x0.12 miles long. If a depth of 220 ft is assigned to these orebodies there would be a tonnage of 240-million tons of iron ore. The average grade of the ore according to the samples taken so far is: Fe, 65%; 0.3-0.4 P; 0.01 S; and between 1 and 2% Si02. Considering the long distance from the coast it is estimated that this mine would have to be exploited at the rate of 12-million tons per year.

Of the Chilean copper produced during 1960, about 90% was sold in Europe and only 10% in the United States. From the copper tax this country obtained $2,625,000 more than in 1959. The taxes paid to the country in 1960 added up to $88,161,447.

Empresa Nacional de Mineria has spent



INTIMATE MIXING speeds reaction in one of eight 3384-gal. uranium oxide strip tanks equipped with turbine-type LIGHTNIN Mixers. Shown here is Baxter Blitz, Plant Engineer, Kermac Nuclear Fuels Corporation, Grants, New Mexico. For complete mixer details, request LIGHTNIN Catalog B-102.

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This was no mere specification-matching choice of mixer. MIXCO people went to Kermac and came home to our lab with samples, plus answers to plenty of questions they'd asked.

Later, when they recommended 5-hp LIGHTNIN Mixers for these strip tanks, there was no question about efficient, dependable mixing—the kind Kermac needs and bought.

This is the way MIXCO solves any fluid-mixing problem you can name so that it *stays* solved. Any materials, any tank size or shape, any power level from ¼ to 500 hp.

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For a third of a century we have made mine ventilating equipment. We feel we can qualify as air delivery specialists. For example: in this mine, 3 ABC MineVent flexible ventilation tubes are delivering air to an area on the other side of an ABC Brattice Cloth stopping. To meet your varied requirements, numerous types of tubing, couplings, accessories, brattice cloth and other items are available. Send for Catalog.
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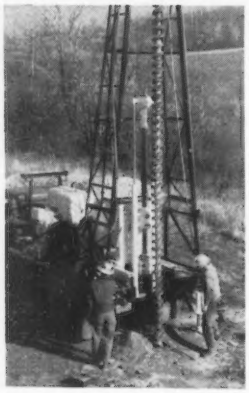
ACKER DOUBLE-DUTY RIG
FOR AUGER BORING OR CORE DRILLING!



Acker SP handles 5 foot hollow-stem or conventional auger flights. Switches to roller rock, carbide, saw tooth or diamond bit coring. The SP handles angle or vertical holes, deep or shallow in any formation.

Core drilling or augering problems anyone? Just name it—the Acker SP will tame it! It's rugged and versatile . . . switches from core boring to augering. It has muscle to auger 300 feet or core to 1500!

Acker's SP is designed for heavy duty service. It has a four speed cathead hoist, built-in reverse and four speed transmission. It's completely self-contained and mounts on truck. Owners of the SP are reporting unprecedented results drilling and augering for soil samples, in hollow stem augering and geophysical and geological exploration.

For more information write for Bulletin 31-ST or have us demonstrate the versatility of this advanced rig. There's no obligation!

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Chile (*Continued*)

$230,000 in improving the crushing plant and bins at the Punta del Cobre mill which can now handle 6000 metric tpm. This mill was built in 1929.

The strike which kept idle the large nitrate plants of Pedro de Valdivia and Maria Elena which produce about 75% of the nitrate of Chile has been settled satisfactorily. The men obtained a raise of 10%.

Japan will buy from Chile 10-million tons of high grade iron ore during a 10 year period. The ore will be bought by the Japanese firms of Yawata and Fuji. The price established is $16.21 when the shipments are larger tan 44,000 tons and 16.51 when the shipments are smaller than 20,000 metric tons.

The National Mining Enterprise is going to build a 20 tpd sulphuric acid plant at the El Salado mill near the port of Chanaral at a cost of $210,000. The plant will use the contact process and the mill will be reconditioned to treat 100 tpd of oxide copper ores which are plentiful in the region.

The 3000-tpd Mantos Blancos mine and mill 28 miles to the east of the port of Antofagasta has begun operations. This is a leaching proposition in which the most abundant copper mineral is atacamite, the oxychloride of copper. The metal will be precipitated as cuprous chloride, smelted with lime to obtain blister copper in a rotating furnace and this copper will be poled to obtained fire-refined copper.

The Secretary for Mines Senor Serrano has ordered Empresa Nacional de Mineria to ask for bids to build an electrolytic refinery next to the Central Copper Smelter of Ventanas. The government Agency for mining contemplates building a refinery with a capacity of either 72,000 or 120,000 tpy of copper.

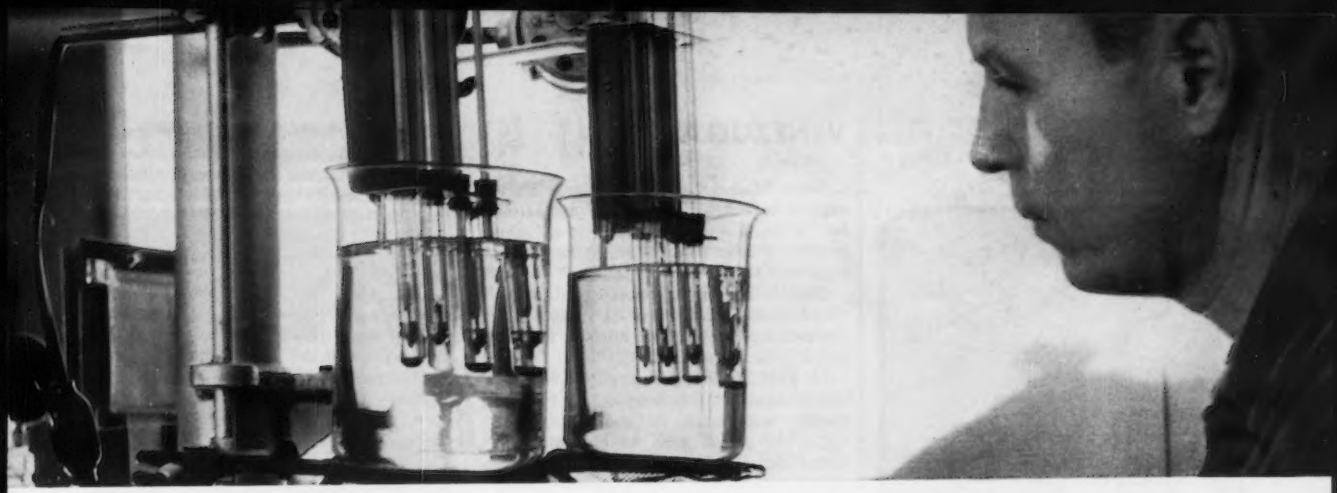
CUBA

The Instituto Cubano de Mineria — Cuba's government mining monopoly — has announced the plan of expending $40-million during the present year to increase the output of copper, manganese, chromite and nickel and cobalt properties in Oriente province, in eastern Cuba.

According to the plans announced, copper production will be increased to 56,000 tpy at the El Cobre mine near Santiago de Cuba. This mine is the oldest in Cuba, having been worked since pre-colonial days.

Manganese production at the Charco Redondo, El Cristo, Alto Songo and Cambute mines will be pushed up to 230,000 tpy. Chromite will be produced at the rate of 60,000 tpy at the Yamaniguey and Cayo Guan mines.

The confiscated American-owned properties at Nicaro and Moa Bay will be set up to produce nickel and cobalt at the rate of 31,000 tpy.



Dropping point test shows how greases react to heat. Beaker fluid has been heated to 390° F. All greases tested except Darina (second tube from left) have passed from solid to liquid state.

BULLETIN:

Shell reveals the remarkable new component in Darina Grease AX that helps it last up to 3 times longer than soap-base greases

Darina® Grease AX is made with Microgel*, the new thickening agent developed by Shell Research.

Severely tested for 18 months, Darina AX with Microgel proved its ability to resist washout, even in mud and slush—stay smooth and buttery at high temperatures—and reduce maintenance.

Read how this superior new multi-purpose grease can help solve your lubricating problems.

THERE IS no soap in Darina Grease AX. No soap to melt away—wash away—or dissolve away.

Instead of soap, Darina AX uses Microgel—a development of Shell Research.

What Microgel does

Because of Microgel, Darina AX has no melting point. It won't run out of bearings.

Even compared to soap-base greases, Darina AX provides significantly greater protection under adverse service conditions.

Resists washout

Mix water into Darina AX and the grease maintains its consistency. It shrugs off water—won't emulsify. For fleets that must operate in snow, slush, rain or mud—Darina AX is an ideal choice.

Longer lubrication life

Shell scientists tested Darina AX, under wet conditions, in a special device called an Oscillating Friction Machine.

Darina AX kept its lubricating qualities twice as long as a premium soda soap-base grease; 2½ times longer than a calcium-soap grease; 3 times longer than an aluminum-soap grease.

Results of field test

In a recent field test, 15 firms used Darina AX in chassis and wheel bearings of over 1000 vehicles. These buses, trucks and vans rolled up 30,097,000 chassis miles. The results:

1. Every company was pleased with the performance of Darina AX.
2. There wasn't one wheel bearing failure due to grease deficiency.
3. In many cases, re-lubrication schedules could be extended.

For details, see your Shell Representative. Or write: Shell Oil Company, 50 W. 50th St., N. Y. 20, N. Y.

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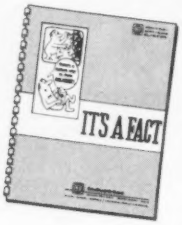

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VENEZUELA

Orinoco Mining Co., US Steel subsidiary, expects to cut back iron ore production by "at least 4-million metric tons" this year — a drop of 25% from the record high of 1960.

The decline is attributed to slow demand in Europe as well as in the U.S. Orinoco has been selling 30% of its output in Europe since 1955.

In 1960, Orinoco shipped 16,968,627 metric tons. Of this amount, 12,515,831 metric tons went to the U.S., and 4,452,796 metric tons to customers in Great Britain, Germany and Italy.

IN AFRICA

South Africa produced 61% of the Free World's supply of gold in 1960, according to banking sources. The Free World's gold output rose 5% to 34,800,000 oz during the year. South Africa's 1960 output was 21,386,114 oz—a rise of 7% on the 1959 total of 20,064,105 oz.

January output from the South African gold mines was 1,820,000 oz, compared with 1,778,000 oz in December and 1,736,000 oz in January 1960. January's value was $64.4-million compared with $60.76-million for the total output in January 1960.

If the present pace of development within the gold mining industry is maintained throughout the year, production in 1961 should shoot up to another all-time high of about 21,800,000 oz worth about $764.4-million which would be roughly $14-million better than the total for last year.

Mineral sales (other than gold and diamonds) from South African sources in 1960 exceeded the 1959 value by about $19-million. With a few very minor exceptions, the figures are up in almost every commodity class. Silver sales represented an increase of 200,000 oz (about 10%); copper (all types) was up 3,300 tons (6%) chrome ore showed an increase of 168,000 tons (25%) and manganese was up by 504,000 tons — an increase of about 55%.

A technical assistance and consulting contract has been signed between a West German consortium, made up of Kloeckner-Humboldt-Deutz AG, Cologne and Stollberger Zinc AG, Aachen, and the Economic Development Organization of Egypt, a state-owned holding company, controlling a number of mining enterprises.

According to the recently-signed agreement, German consulting engineers will supervise prospecting at copper, zinc and lead deposits owned by EDO in the Egyptian deserts. The Germans will also help to buy mine machinery and set up the ore industries.

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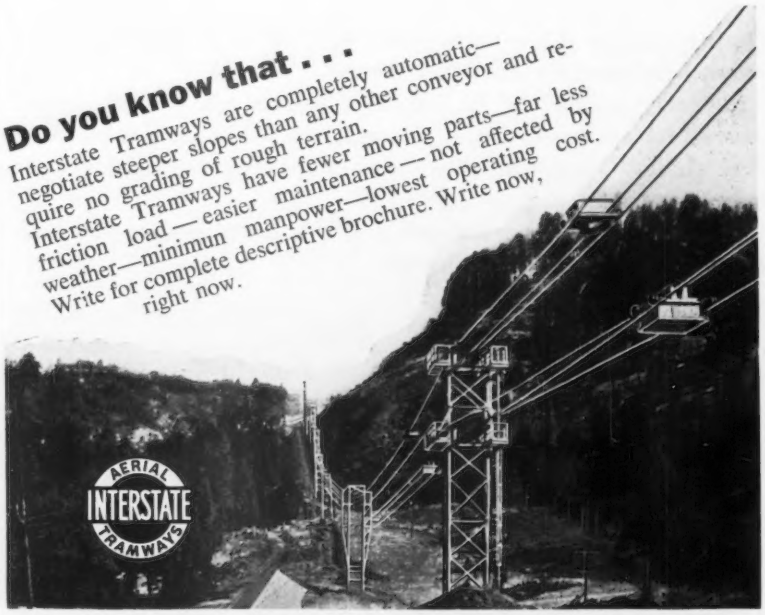

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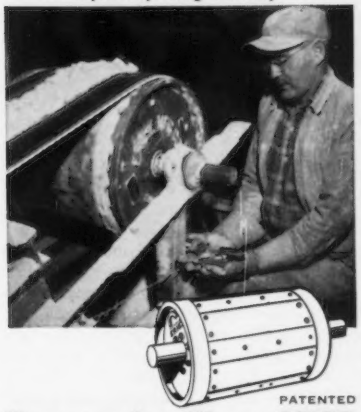

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How much will an ERIEZ PERMANENT MAGNETIC PULLEY save you?

Erium® powered Eriez magnetic pulleys save one firm $1200 a year by removing 50 pounds of tramp iron a week from coarse clay. They can save you as much—or more, depending on your application.

In addition to preventing machinery damage, Eriez permanent magnetic pulleys prevent fires and explosions; assure product quality.

The pulley illustrated is one of 192 sizes (up to 36″ diameter in any belt width) made by Eriez. **There is one for your exact application.** Two basic models are available: **Type AA,** ideal for separating small and medium tramp iron and fine ferrous contamination; **Type CR,** which performs best in removing large pieces of tramp iron.

All models are engineered and constructed to give you the finest in automatic separation. All are powered by Erium®—our exclusively-designed power source. Model for model, Eriez units give you the finest quality and consistency of magnetic strength.

For descriptive bulletin write to:

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We willingly share our design and application know-how to help our customers find new ways to improve their plant efficiency and product quality.

E. J. TENPAS
Supervisor, Magnetic Engineering

ERIEZ

A GROWTH COMPANY...
10 NEW PRODUCTS IN THE LAST 5 YEARS

IN THE PHILIPPINES

The largest dollar producer mining company in the Philippines during 1960 was Benguet Consolidated, with gold output valued at 33.8-million pesos. Consolidated Mines was the runner-up, with production of 596,491 tons of chromite ore, worth 27.7-million pesos. Third high was Lepanto Consolidated, a copper-gold mine which reported 26.0-million pesos.

Company	Product	Tonnage
Benguet Consol.	Gold	235,001 oz.
Consolidated Mines	Chromite	596,491 tons
Lepanto Consolidated	Copper, gold	470,413 tons ore
Atlas Cons.	Copper	35,623,763 lbs.
Philippine Iron Mines	Iron	1,052,411 tons
Marinduque Iron Mines	Copper	25,672,811 lbs.
Itogan Mining Co.	Gold	288,207 tons ore
Philex Mining	Gold, copper	665,564 tons ore
Acoje	Chromite	123,529 tons

The flotation section of the 35-ton mill of Benguet Exploration Co. is now in operation and a concentrate containing 50% zinc and 0.3 oz gold is being produced. The flotation section will treat all of daily mill run ore as well as some impounded tailings. Mill heads are running 0.9 oz gold and 8% zinc. Mill capacity is being increased to 50 tpd. A diamond drilling program and development work during the year has been very satisfactory.

Manila Mining Co. reports good results from development work on its Aguson property in Mindanao. It is believed that the property will be ready for a small mill in about six months.

IN EUROPE

USSR

The Russians are said to be using the electronic blasting of coal with some success. In an interview with an executive of Valvo, one of West Germany's major tube and transistor manufacturers, it was revealed that the West German Mining Research Institute recently shipped a wagon load of hard coal to Valvo's research installation. Using a two to five kilowatt continuous-wave magnetron developing radio frequency power at 2400 megacycles, Valvo is hoping to be able to boil the moisture in the area surrounding the hole drilled to take the system antenna. By creating sufficient steam pressure, they hope to be able to loosen the coal deposits.

Canadian engineers are also said to be studying similar techniques.

Important deposits of magnetic iron ore were discovered recently in Central Asian districts of the USSR, giving this area a sound basis for hard-pushed industrialization.

Aero-magnetic exploration resulted in spotting one deposit, an anomaly of

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60 seconds that will help you improve operating efficiency.

CLOGGED BINS A PROBLEM?

If troublesome slowdowns caused by sticking, arching, stubborn materials are your problem, here's good news:

Eriez Hi-Vi® electro-permanent magnetic Unit (Bin) Vibrators are your answer. They've proven superior time and again for dependable movement of stubborn masses of granular, lumpy or powdered materials in bins or hoppers.

Their concentrated vibration is directed to deliver maximum efficiency precisely where it is needed. The full Hi-Vi line offers models for use with all sizes of bins with wall thickness to ½″ — Special models are available for hazardous, dusty locations.

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- Direct AC operation — no need for rectifiers.
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- Weather-and-dust-resistant housings at no extra cost.
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USSR (*Continued*)

magnetic iron ore, in the North of the "virgin-land" region of Kazakhstan. Seams ranging between 15 and 30 ft are covered by only 100 ft of waste rock.

Two additional deposits — one of which is estimated to contain 200-million metric tons of economically mineable ore — were discovered in the southwestern part near Shagyrkul.

Results of aero-magnetic exploration work are to be correlated by work of 20 geological teams operating now in Kazakhstan's virgin land district.

FINLAND

The mining industry in Finland has witnessed a spectacular development in the past ten years and is now responsible for 18% of the world's vanadium supply, 10% of the world's cobalt supply and 3% of the world's titanium supply.

In 1950, Finland's total mining production was 70-million tons, and is now about three times that amount, with total production at approximately 200-million tpy.

Copper has taken great steps forward, and production of the metal is now about double the domestic requirement. A considerable part of it is converted into semi-manufactured shapes and billets for the country's engineering, electricity and building industries. The Pyhasalmi mine will start its production in 1962 and will increase Finland's copper production by about 15%, and zinc production by approximately 30%.

An iron ore mine under construction at Jussaro will increase the domestic production of iron by nearly a third. The exploitation of the iron ore fields at Raajarvi and Kolar is also being planned.

GERMANY

A new TV probe has been developed by four German engineers employed with Eastman International Co., Hanover, in cooperation with Grundig and the Austrian Engineering Bureau for Geology and Construction. The new operation permits direct observation as well as photographic recording of geological conditions in drilled holes down to a depth of 1312 ft. While the conventional coring method required several drill holes for producing adequate information on direction of the various geological layers, on cracks, and fissures and faults, the tiny TV probe can supply all information from one drilling — and usually with greater accuracy. Probe length is 4.6 ft, O.D. 25 in., pressure resistance 735 PSI. It is hoped that in a few years the probe will be suitable for deep-drilling as well.

The head of the Communist Metal Workers Union, Rolf Berger, has put up the alternative to East German metal workers either to produce goods of better quality or to suffer cuts in wages.

Solving wet gravity ore recovery, sizing and separating problems since 1912.

ORE CONCENTRATING TABLES
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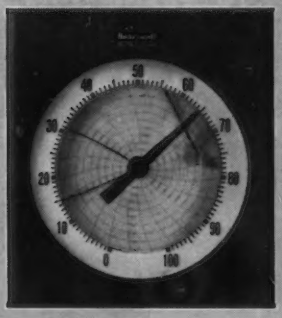
◀ TRAVELING ALONG KILN SHELL on steel cable, the *Radiamatic* unit provides continuous temperature measurement.



ElectroniK CIRCULAR CHART RECORDER records kiln shell temperatures and reference points showing position of *Radiamatic* along kiln.

RADIAMATIC RADIATION DETECTOR responds to 98 per cent of any temperature change within two seconds, is automatically compensated for ambient temperatures up to 250°F.

Hot Spot Problems?

U.S. Steel's Universal Atlas Cement Division, Gary, Indiana, has solved the problem of kiln hot spots with a *Radiamatic* infrared radiation detector. The Radiamatic unit automatically travels back and forth along the kiln shell on a steel cable and provides a continuous measurement of kiln temperature. The same system can be used to avoid costly downtime in smelters and furnaces.

The *Radiamatic* unit works with an *ElectroniK* circular chart potentiometer, which records both temperatures and reference points along the length of the hot zone. When the temperature at any point reaches a preset limit, a light flashes, warning that a potential hot spot is developing.

Not only does this system save production time; it also keeps molten metal and fumes where they belong—inside the smelter. Your nearby Honeywell field engineer can give you complete details on the system that's best for your application. Call him today . . . he's as near as your phone.

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GREAT BRITAIN

Fluospar and galena have been found during borings to 1280 ft in the Pennines at Rookhope, County Durham and may be exploited commercially if they exist in sufficient quantity.

Drilling has already shown valuable deposits at three times the depth of local mining and is to go still deeper. It is financed by a $400,000 special research grant to Durham University.

IN AUSTRALIA

Extensive testing at the recently discovered deposit of limonitic iron ore in the southwestern part of the state has cording to Norman Fernie, the managing director of the Griffin Coal Mining Co. disclosed 100-million tons of ore ac- The company and Heine Bros., Ltd., of Melbourne, have formed the Mineral Mining & Export Co., with main officer in Perth, to develop the deposit.

LETTERS

THE MIDAS TOUCH

Thank you for your wonderful editorial in the February issue. I wish it could get into the hands of every member of Congress. There are divergent views, but if the *need* is made paramount, a way could be worked out.

I think the results from renewed gold mining could supply in large measure what President Kennedy wants: reduced unemployment, unused capacity working, spurred new production and the fostering of higher economic growth. Mining could give employment to thousands directly and indirectly; it could create a gigantic market for equipment and supplies, and start a new tax source from mines themselves, workers and manufacturers that could possibly equal a subsidy. All from starting a new industry that would be pouring out newly mined gold into Fort Knox. All the gold in existence came out of the gound somewhere. There is plenty more in the ground, and if the Government needs it and wants it mined, a way can surely be created to make it possible.

H. E. Bush
Mining Engineer
Newport Beach, Calif.

WE STAND CORRECTED

Our attention has been drawn to an error which appeared in the February, 1961, issue of the *Engineering And Mining Journal*, on page 110, in the six line summary of barite. The figure for the estimated production in 1960 should be 726,000 tons. This was incorrectly stated as 276,000 tons.

The correct figure was used in the article on page 118.

Carlton H. Rose
National Lead Co.

NEW

volume and density measurements in minutes

The new Beckman Model 930 Air Comparison Pycnometer* is a revolutionary means of making volume measurements for accurate, fast *density* determinations of irregular, powdered and porous solids.

• *Quick*...volume readings in one to five minutes, saving hours over conventional methods.

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• *Rugged*...portable...mechanical, requires no electric power.

For more information about this time-saving new technique for making *true volume, apparent volume, porosity,* and *density* determinations, contact your Beckman authorized laboratory apparatus dealer, or write for Data File 27-4-23.

*PAT. PENDING

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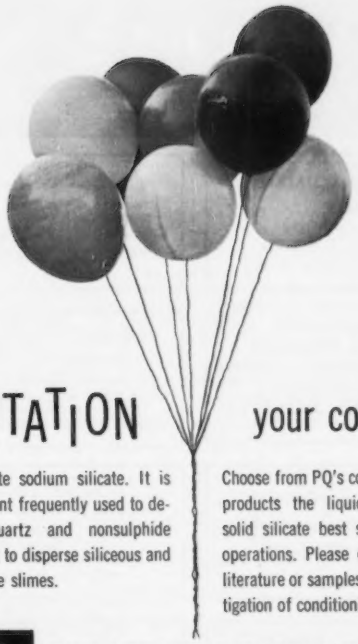

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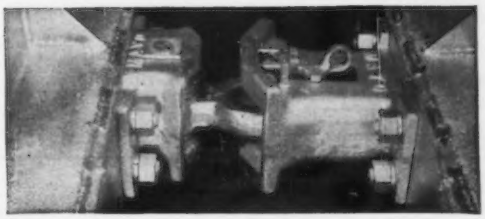

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. . . the coupler with the mating instinct

Mayo's new, cast steel coupler for narrow gauge mine cars couples instantly on tangent or curves. Safe, self-centering link completely eliminates all hazards of hand couplings. Only a little more expensive than link-and-pin, it more than pays for itself by preventing accidents. If you can save one smashed finger, you've got these couplers paid for. Easily installed by bolting to existing cars. Write for Bulletin No. 21.

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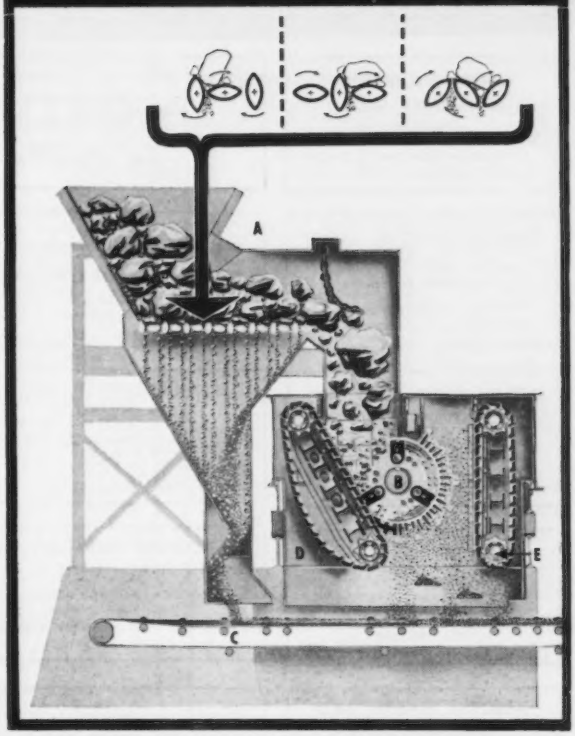

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The exclusive Universal Wobbler Feeder (patented) and Bulldog Hammermill combination was engineered for one of the world's largest cement mills to average 600 tons per hour. It can increase *your* capacity up to 100%! Here's why.

The Wobbler Feeder (A) feeds the Bulldog Hammermill (B). Its tumbling, rocking motion sifts fines and clay through the bars to under conveyor (C). Only clean oversize rock is delivered to the Hammermill. The Wobbler Feeder scalps as it feeds without blinding or plugging, particularly valuable when wet, sticky material is a problem. Bulldog Hammermill's traveling breaker plate (D) and cleaning bar (E) eliminate build-up of sticky material in breaking chamber. Your crushing operation keeps going without clogging or jamming regardless of moisture present.

Since the Wobbler Feeder sends only oversize to the Bulldog Hammermill, the Bulldog can handle more material per day. Add this efficient, no-waste breaking power to the double, non-clog protection of this new combination and you can increase your production up to as much as 100%!

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(Continued on opposite page)

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1—6' dia x 6 disc Eimco, Vac. pump, complete

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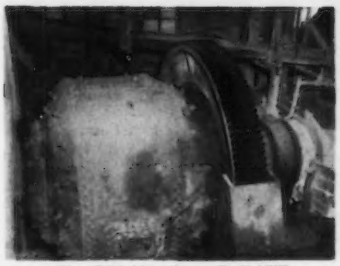
1—4 cell 16"x16" Denver, "Sub A"
1—1000 gm Gallgher Lab. Glass bowl
1—6 cell #21 Denver "Sub A"
1—8 cell #18 Special Denver "Sub A"

HOISTS, TUGGER & SLUSHER
1—FF311 Joy 3 drum, 10 HP 440 V.
3—10NNIG Ing. Rand, 2 drum, 10 HP 440 V.
7—FF211 Joy, 2 drum, 10 HP 440 V.
10—HB Gardner Denver, 1 drum, Air, 1250#



7' x 36" Hardinge Ball Mill

8—L-111 Joy 1 drum, Air, 2000#
10—HU Ing. Rand, 1 drum, Air, 2000#

HOISTS, MINE SHAFT
1—165 HP Denver Engineering, 2 drum, 440 V.
1—100 HP Denver Eng., 1 drum 440 V.
1—150 HP Vulcan-Denver, 1 drum, New
1—600 HP Vulcan Wilkes Barre, 2 drum, 2300 V.
1—675 HP Vulcan Wilkes Barre, 2 drum, 2300 V.

HYDRO SEPARATORS
1—36'x10' Process Engineers, Steel tank
2—24'x8' Process Engineers, Steel Tanks

JIGS
1—12"x18" Denver Duplex, Mineral
1—16"x24" Denver Duplex, Mineral
1—42"x42" Yuba, M-8, 2 cell
12—42"x42" Yuba, M-8, 4 cell

KILN
1—48"x30' Ruggles-Cole Hardinge, gas—oil

LOCOMOTIVES
4—1½ ton Mancha "Little Trammer" 18"-24" ga
1—4 ton Mancha "Electric Mule" 24 ga
1—8 ton Plymouth Diesel, DHD, 24" ga
1—6 ton Mancha "Std AN," Battery, 24" ga

MAGNETS
1—24"x24" Magnetic Pulley 250 V. DC
2—24"x30" Dings Magnetic Perma-Pulley

MILLS
1—7'x48" Hardinge Conical, Lg. Trunnion, 150 HP
1—7'x22" Hardinge Conical, Lg. Trunnion, 75 HP
1—7'x36" Hardinge Conical, Lg. Trunnion, 100 HP
1—7'x5' Allis Chalmers, grate type, 150 HP
1—5'x10' Marcy, overflow, 100 HP

MUCKING MACHINES
2—#21 Eimco Rocker Shovel, 24" ga
2—#12 B Eimco Rocker Shovel 24" ga

PRESS
2—Size 30, Sperry Filter, 30"x30"

PUMPS
1—2GT Ing. Rand 50 HP 440 V.
2—1MRVN-7½ Ing. Rand 7½ HP, 440 V.
1—1MRVH-15 Ing. Rand 15 HP 440 V.
2—2MRV-25 Ing. Rand 25 HP 440 V.
2—5RVL-30 Ing. Rand 30 HP 440 V.
2—16" Cascade Sump, 7440gpm, 30 HP
1—2" Denver Equip. Simplex Diaphram
1—6" Fairbanks Morse, 300 HP Regutron Control
2—14" Yuba, Model AA, 250 HP 5500gpm
1—10" Yuba, Model S, 2400gpm
1—16" Wintroath Deepwell, 100 HP Regutron Control
2—8" Dorrco Duplex, Type W, 5 HP
3—6" Dorrco Duplex, VM, 3 HP

VACUUM PUMPS
2—18"x6" Ing. Rand ER-1 15 HP 440 V.
1—17"x10" Chicago Pneumatic NISB 25 HP

SAND WHEELS
4—12½'x4' Conveyco Duplex, 20 HP

SCREENS
1—41"x66" Jeffrey-Traylor, F8-2, 1 deck, MG set
1—9' dia x 54½' Yuba, Trommel, 100 HP
3—4'x12' Tyler Tyrock, 1 deck 10 HP
3—6'x14' Hewitt Robins, MH-11, Scalping
2—6'x12' Allis Chalmers, Lowhead
1—4'x8' Tyler Hummer
1—4'x10' Tyler Hummer

SEPARATORS WITH RECTIFIERS
1—HS-218 Carpco, High tension
4—HT-460 Carpco, High tension
4—MI-418 Carpco, Magnetic
1—HS-418 Carpco, High tension
1—Memco-Hope, 16½'x12", 3 cross belt
1—30"x75" Stearns Mag. Drum, type WPD

SHOVELS
1—20B Bucyrus Erie W/dragline
1—111M Marion Diesel Electric W/3½ yd Dragline
1—54B Bucyrus Erie Dragline
1—170B Bucyrus Erie, 7 yd. Electric

TELEPHONES
1—Graybar Mine, Aluminum case
7—Western Electric, Cast case

THICKENERS
1—100' Dorrco Traction, 3 HP gearmotor
1—120' Dorrco Traction, Type IC, 5 HP

TIMBER FRAMER
1—Searns Roger Single End. 440 V. Exc.

TRACTORS
1—75A Michigan Loader Waukesha Gas
1—105 Eimco, Angle Dozer, Carco winch

TRANSFORMERS
3—833 Westinghouse, 55000-2400, Disc

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72″ x 64″, double drum, 400 H.P.
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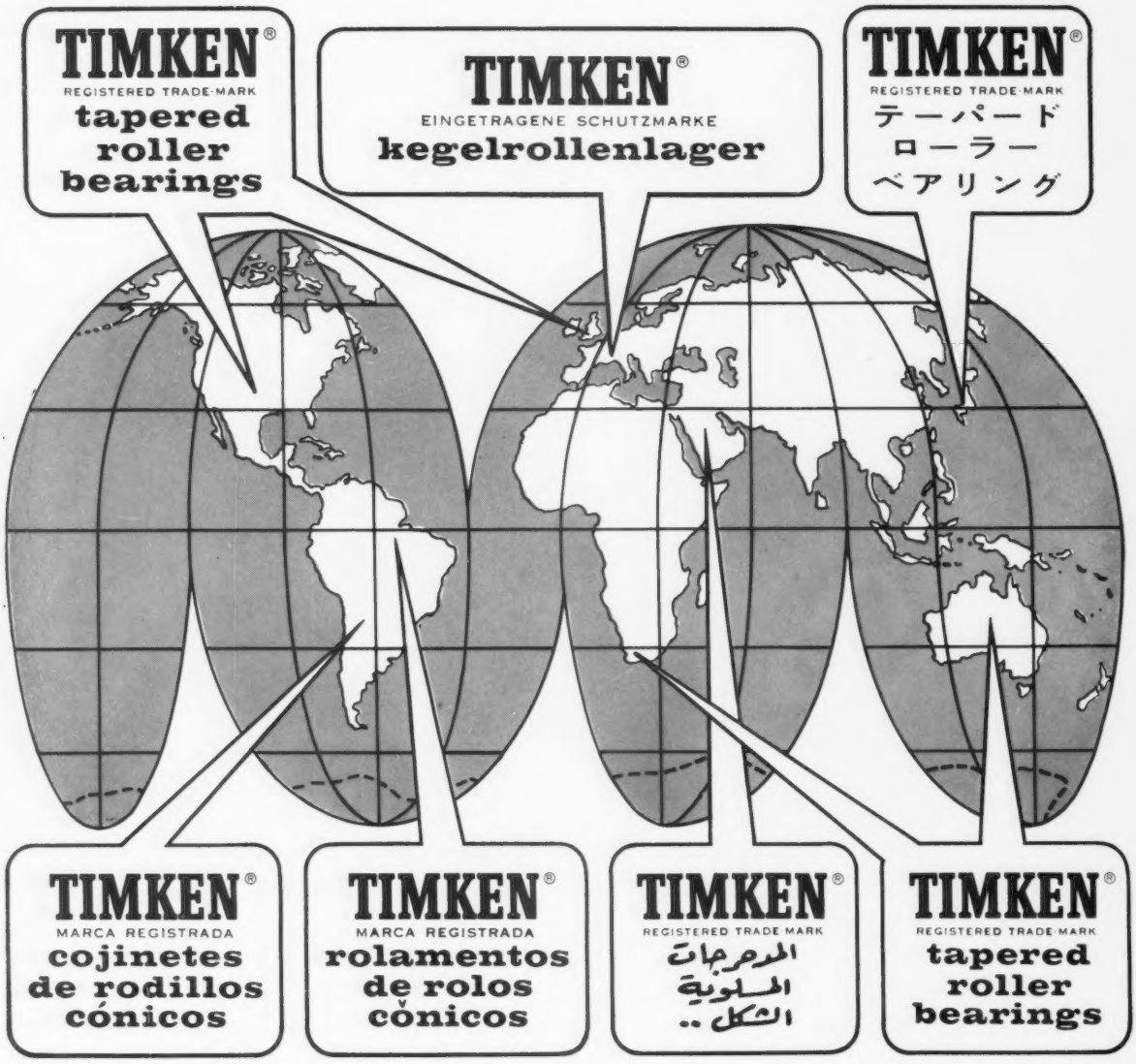

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